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ABSTRACT

Modern aircrew training devices (ATDs) are equipped with sophisticated hardware and software capabilities, known as advanced instructional features (AIFs), that permit a simulator instructor to prepare briefings, manage training, vary task difficulty/fidelity, monitor performance, and provide feedback for flight simulation training missions. The utility and use of the AIF capabilities of Air Force ATDs were explored by means of a survey of 534 simulator instructors from Air Training Command, Military Airlift Command, Strategic Air Command, and Tactical Air Command training sites. The primary purpose of the survey was to provide a database that could be used in defining the requirements for ATD procurement and in developing future ATD training programs. The results indicated that, in general, the features that were rated highest were those used for training management, variation of task difficulty/fidelity, and monitoring student performance. The level of AIF use was affected somewhat by hardware and/or software unreliability, implementation time, functional limitations, and design deficiencies. However, the presumed training value of an AIF was the most important determinant of its use. Recommendations were made concerning the AIF capabilities of future ATDs and research aimed at determining the principles of effective AIF use. The survey instruments are appended. (Author/KC)

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HUMAN RESOURCES

LABORATORY

AIRCREW TRAINING DEVICES: UTILITY AND UTILIZATION OF ADVANCED INSTRUCTIONAL FEATURES (PHASE IV - SUMMARY REPORT)

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An aircrew training device (ATD) is not merely a flight simulator. It is also equipped with sophisticated hardware and software capabilities, known as advanced instructional features (AIFs), that permit a simulator instructor to control, monitor, and create simulator training missions. This report summarizes a three-phase project designed to determine the utility and utilization of AIFs based on a survey of simulator instructors from the Air Force Major Commands. Phase I surveyed 134 instructor pilots and weapon director instructors assigned to principal Tactical Air Command (TAC) ATD training sites. Phase II surveyed 273 instructor pilots, flight engineers, and radar/navigators from Air Training Command (ATC), Military Airlift Command (MAC), and Strategic Air Command (SAC). Phase III extended the survey to 155 electronic warfare and aerial gunnery instructors from ATC, SAC, and TAC training facilities. The results indicated that the level of AIF use was affected somewhat by hardware and software unreliability, implementation time, functional limitations, and design deficiencies. However, the perceived training value of a feature was the most important determinant of its use. In addition, it was recommended that the training of simulator instructors be improved. Training should include not only how to

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use AIFs but how to use them effectively. Guidelines need to be specified for the effective use of AIFs. It is not sufficient to know how to use a feature; when to use it must also be known. Also, AIFs need to be made more reliable and user-friendly.

SUMMARY

Modern Aircrew Training Devices (ATDs) are equipped with sophisticated hardware and software capabilities, known as Advanced Instructional Features (AIFs), that permit a simulator instructor (SI) to prepare briefings, manage training, vary task difficulty/fidelity, monitor performance, and provide feedback for flight simulation training missions. The utility and utilization of the AIF capabilities of Air Force ATDs was explored by means of a survey of 534 SIs from Air Training Command, Military Airlift Command, Strategic Air Command, and Tactical Air Command training sites. The primary purpose of the survey was to provide a database that could be used in defining the requirements for ATD procurements and in developing future ATD training programs. In general, the features that were rated highest were those used for training management, variation of task difficulty/fidelity, and monitoring student performance. The level of AIF use was affected somewhat by hardware and/or software unreliability, implementation time, functional limitations, and design deficiencies. However, the presumed training value of an AIF was the most important determinant of its use. Recommendations are made concerning the AIF capabilities of future ATDs and research aimed at determining the principles of effective AIF use.

PREFACE

This effort was conducted to satisfy the requirements of Air Force Human Resources Laboratory Technical Planning Objective 3, the thrust of which is aircrew training effectiveness. The general objective of this thrust is to identify and demonstrate cost-effective simulator training strategies and training equipment capabilities for use in developing and cost-effectively maintaining the combat readiness of Air Force aircrew members. More specifically, the research was conducted under the Air Combat Training Research subthrust, the goal of which is to provide a technology base for training high-level and quickly perishable skills in simulated combat environments. Dr. Gary S. Thomas (AFHRL/OTU) was the Project Monitor; Dr. Donald J. Polzella and Dr. David C. Hubbard were the Co-Investigators, both of whom were employed by the University of Dayton Research Institute.

This effort was jointly coordinated by the Air Force Human Resources Laboratory, Operations Training Division, Williams Air Force Base, Arizona; Aeronautical Systems Division (AFSC/ASD), Wright-Patterson Air Force Base, Ohio; Headquarters Air Training Command (ATC), Randolph Air Force Base, Texas; Headquarters Military Airlift Command (MAC), Scott Air Force Base, Illinois; Headquarters Strategic Air Command (SAC), Offutt Air Force Base, Nebraska; and Headquarters Tactical Air Command (TAC), Langley Air Force Base, Virginia. The authors gratefully acknowledge the assistance of the following individuals in the preparation of this report:

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AIRCREW TRAINING DEVICES: UTILITY AND UTILIZATION OF ADVANCED INSTRUCTIONAL FEATURES (PHASE IV - SUMMARY REPORT)

I. INTRODUCTION

An Aircrew Training Device (ATD) is a ground-based substitute aircraft that permits student flight crews to fly in a safe and carefully controlled environment. It is frequently assumed that the training value (i.e., utility) of an ATD is a function of its fidelity or capability for simulation. According to Adams (1972), this assumption could be unwarranted.

> I would not consider the money being spent on flight simulators as staggering if we knew much about their training value, which we do not. We build flight simulators as realistic as possible, . . . but the approach is also a cover-up for our ignorance about transfer because in our doubts we have made costly devices as realistic as we can in the hopes of gaining as much transfer as we can. [In the past], the users have been willing to pay the price, but the result has been an avoidance of the more challenging question of how the transfer might be accomplished in other ways, or whether all that complexity (i.e., fidelity) is really necessary. (pp. 616-617)

It is important to realize that an ATD is primarily an instructional device that is designed to facilitate the acquisition of flight crew skills. Thus, the training value of an ATD is determined not by the degree to which it faithfully simulates a particular aircraft but by the way that it is used (Caro, 1973). Yet, it appears that military ATDs are more often thought of as substitute aircraft than as instructional tools. A recent report by the United States General Accounting Office (1983) concluded that the armed services have not sufficiently analyzed their training requirements for simulators. Nor have they adequately incorporated simulators into their training programs. In justifying the purchase of ATDs, the services have focused instead on "duplicating the actual weapon systems and their surroundings . . . with little reference to how the devices could meet training needs" (p. 4). The GAO report makes two recommendations to the Secretary of Defense:

1. Approve budget requests for flight simulators only after the services have analyzed their training needs and proven that the needs cannot be met with existing simulators.

2. Require the services to incorporate simulators into their training programs. (p. 7).

It is clear from the report that if the armed services are to follow these recommendations, they must better utilize and understand the instructional capabilities of ATDs.

Advanced Instructional Features

In order to fulfill its function as an instructional device, an ATD is equipped with sophisticated hardware and software capabilities that permit a Simulator Instructor (SI) to brief, control, monitor, and provide feedback during simulated training missions. These capabilities, some of which are listed in Table 1, are known as Advanced Instructional Features (AIFs). The list was compiled from several sources, but it was drawn primarily from Semple, Cotton, and Sullivan's (1981) extensive report describing the AIF capabilities of various military and commercial devices. Instructional features are expensive to implement, especially those features that require the development of complex software. In order to justify these costs, some questions concerning the present and potential utility and utilization of AIFs should be answered: How frequently and easily are AIFs used? Are SIs adequately trained to use AIFs? Do AIFs have significant training value?

Table 1. Advanced Instructional Features

BRIEFING FEATURES

* Recorded Briefing permits SI to provide student with information about the simulator and/or a training mission through audiovisual media presentation.

* Demonstration permits SI to demonstrate optimal aircrew performance by means of prerecording and subsequently playing back segments of simulated flight.

* Instructor Tutorial provides SI with self-paced programmed instruction in the capabilities and use of the simulator.

TRAINING MANAGEMENT FEATURES

* Total System Freeze permits SI to suspend simulated flight by freezing all system parameters.

* Reset permits SI to return the simulated aircraft to a stored set of conditions and parameters.

* Crash and/or Kill Override permits SI to allow simulated flight to continue without interruption following a "crash" or "kill."

* Automated Adaptive Training is the computer-controlled variation in task difficulty, complexity, and/or sequence based on student's performance.

* Programmed Mission Scenarios are computer-controlled training missions based on pre-programmed event sequences.

* Manual Mission Control permits SI to modify programmed scenarios during a training session.

Table 1 (Continued)

VARIATION OF TASK DIFFICULTY/FIDELITY FEATURES

* Automated Malfunction Insertion permits SI to preprogram a sequence of aircraft component malfunctions and/or emergency conditions.

  Manual Malfunction Insertion permits SI to modify preprogrammed malfunctions during a training session.

* Environmental permits SI to vary environmental conditions such as wind direction and velocity, turbulence, temperature, and visibility.

  Dynamics permits SI to vary flight dynamics characteristics such as stability, system gain, cross-coupling, etc.

* Motion permits SI to provide student with platform motion system cues such as roll, pitch, lateral, and vertical.

* Partial Freeze permits SI to freeze any one or a combination of flight parameters. Variations of this feature include:

  Flight System Freeze, which permits SI to simultaneously freeze flight control and propulsion systems, position, altitude, and heading;

  Position Freeze, which permits SI to simultaneously freeze latitude and longitude; and

  Attitude Freeze, which permits SI to simultaneously freeze pitch, bank, and heading.

MONITORING FEATURES

  Closed Circuit TV permits SI to monitor student's behavior from the instructor console.

  Repeaters/Annunciators provide SI with replicas or analog representations of flight instruments and controls at the instructor console.

* Instructor Console Displays permit SI to monitor parameters and procedures at the instructor console by means of alphanumeric and/or graphic cathode-ray tube (CRT) displays of performance data (in the survey this was referred to as Parameters and Procedures Monitoring).

  Automated Performance Alert provides SI with visual and/or auditory signals that indicate specific performance deficiencies.

Table 1 (Concluded)

FEEDBACK FEATURES

* Record/Playback permits SI to store and subsequently play back a segment of simulated flight.

* Automated Performance Feedback provides student with visual and/or auditory signals (including verbal messages) that identify performance deficiencies.

  Automated Voice Controller is the computer-based technology that simulates the role of controller by combining speech generation, speech recognition, and situation awareness capabilities.

* Hard Copy provides an alphanumeric and/or graphic record of performance data.

* Performance Scoring provides a metric(s) that summarizes aircrew task performance during a simulated mission.

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* These features were surveyed during one or more phases of the project.

Answers to these questions have not been fully provided, but relevant information is available. One source of information is a series of reports describing the automated instructional system on the Advanced Simulator for Pilot Training (ASPT) at Williams AFB, Arizona (Faconti & Epps, 1975; Faconti, Mortimer, & Simpson, 1970; Fuller, Waag, & Martin, 1980; Knoop, 1973). The ASPT is a sophisticated research device that incorporates advanced visual and motion systems, A-10 and F-16 cockpits, extensive AIF capability, and an automated performance measurement system. Notwithstanding the apparent training potential of the ASPT, Gray, Chun, Warner, and Eubanks (1981) found that SIs tended to use the device in a fairly conventional manner. With few exceptions, the instructional features were rarely used.

AIF utility information is available in an important series of reports by R. G. Hughes et al. (Bailey & Hughes, 1980; Bailey, Hughes, & Jones, 1980; Hughes, 1979; Hughes, Hannon, & Jones, 1979; Hughes, Lintern, Wightman, Brooks, & Singleton, 1982). The reports provide conceptual models for AIF-based simulator training programs and present experimental evidence aimed at determining the training value of particular features. It is clear from these reports that effective AIF-based simulator training is practicable, but systematic analyses of AIF utility and utilization patterns are required before optimal training programs, of the kind envisioned by Knoop (1973), can be designed:

> The software which will comprise flight simulators of the future will consist primarily of sophisticated advanced training programs which automatically step the student through training, measure his performance at each step, diagnose his problems, and alter the difficulty of various tasks which are commensurate with his skill. (p. 583)

A great deal of information concerning AIFs can be found in the design guides of Caro, Pohlman, and Isley (1979) and Easter, Kryway, Olson, Peters, Slemon, and Obermayer (1986a, 1986b) and in the Semple et al. (1981) report mentioned previously. This latter report is probably the most comprehensive source. It was based on interviews of ATD personnel at 12 Air Force, Navy, Army, Coast Guard, and commercial training sites and is one of seven reports comprising the Air Force Simulator Training Requirements and Effectiveness Study (STRES). The report describes over 20 AIFs and discusses each in terms of its operation, related instructional features, instructional value, observed applications, utilization information, related research, and design considerations. The interviews were "guided" by a checklist of topics, but they were not highly structured. This approach afforded the investigators flexibility in exploring particular topics, but it precluded systematic analyses of the data.

The Present Investigation

The present investigation was conducted at the request of the Simulator System Program Office (SimSPO) of the Air Force Systems Command, Aeronautical Systems Division (AFSC/ASD). The objectives of the investigation were:

1. To document and compare the utilization (i.e., frequency and ease of use) of AIFs,

2. To document and compare the utility (i.e., training value) of AIFs,

3. To document and compare instructor training in the use of AIFs,

4. To compare the utility and utilization patterns of AIFs in replacement (e.g., basic, primary, lead-in, initial, formal, transition) and continuation (e.g., advanced, follow-on, refresher, operational) training units,

5. To compare the utility and utilization patterns of AIFs across the Air Force Major Commands (MAJCOMs), and

6. To make recommendations concerning the inclusion of AIFs on future ATDs and their use in current and future training programs.

The approach of the investigation consisted of surveying SIs from the MAJCOMs in three phases between March 1982 and September 1984. Instructor pilots (IPs) and weapon director instructors from Tactical Air Command (TAC) were surveyed in Phase I. IPs, flight engineers, and radar/navigators from Air Training Command (ATC), Military Airlift Command (MAC), and Strategic Air Command (SAC) were surveyed in Phase II. Electronic warfare instructors, aerial gunnery instructors, and weapon system officers from ATC, SAC, and TAC were surveyed in Phase III. The results of those phases are documented in three previous reports (Polzella, 1983, 1985; Polzella & Hubbard, 1985). The present report completes the final phase of the investigation with a summary of the entire database.

The purpose of this summary is threefold: (a) to extract findings that are generalizable across MAJCOMs and/or levels of training, (b) to determine differences that may exist across MAJCOMs and/or levels of training, and (c) to make recommendations for the inclusion of AIFs on new ATDs. The information contained in this report should be supplemented with experimental data, since the conclusions and recommendations are derived from a database consisting almost entirely of subjective judgments.

II. METHOD

Subjects

The subjects were 534 simulator-qualified flight crew instructors (SIs) assigned to various ATC (T-50, T-51, T-5), MAC (C-5A, C-141, CH-3, HH-53, C-130), SAC (FB-111A, T-4, B-52 weapon system trainer [WST]), and TAC (F-4E, F-4G, F-15, A-10, E-3A) training sites. The subjects included IPs, weapon directors (WDIs), flight engineers (IFEs), radar/navigators (IRNs), aerial gunners (IAGs), and electronic warfare officers (EWIs). The distribution of particular SIs among the various levels of training and ATD sites that were surveyed in the various phases are shown in Appendix Tables A-1 through A-3. Also included are the SIs' mean (and standard deviation) number of hours of instructor experience. A summary of this information is presented in Table 2.

Questionnaires

The questionnaires that were used to survey the instructors are shown in Appendix B, Phases I, II, and III. It was necessary to construct a separate version of the questionnaire for each phase of the investigation, due to differences in the training requirements and capabilities of the various ATD sites. However, the resulting versions were similar in most respects.

The first page of each questionnaire requested information concerning instructor experience, a description of a typical simulator training session, and general comments and/or recommendations. The second page of each questionnaire listed the features that were to be surveyed, along with their definitions. The list consisted of from 14 to 17 AIFs (depending on the version) drawn from Table 1. A total of 19 AIFs were surveyed during one or more phases of the project.

Table 2. Simulator Instructors (SIs) Surveyed During This Investigation

Command	ATD	Number of SIs	Mean number of instructor hours
ATC	T-50	29	173.6
	T-51	21	129.4
	T-5 (EW)	19	287.4

Table 2 (Concluded)

Command	ATD	Number of SIs	Mean number of instructor hours
MAC	C-5A	46	490.0
	C-141	53	727.7
	C-130	34	238.8
	CH-3	11	212.0
	HH-53	17	381.5
SAC	FB-111A	30	474.8
	FB-111A (EW)	32	361.0
	T-4 (EW)	28	576.3
	B-52 WST (EW)	15	563.4
TAC	F-4E/G	26	215.0
	F-4G (EW)	32	95.6
	F-15	39	144.0
	A-10	38	21.7
	A-10 (EW)	33	75.0
	E-3A FS	8	351.3
	E-3A MS	23	448.1

On the remaining pages of the survey were five questions concerning the utility and utilization of each feature. For Phases I and II, the questions were worded as follows:

1. How often have you used each instructional feature?
2. How easy is it to use each instructional feature?
3. How much training did you receive in the use of each instructional feature?
4. Rate the training value of each instructional feature.
5. Rate the potential training value of each instructional feature.

The questions were altered somewhat for Phase III, at the request of TAC/DOT:

1. During five typical missions, how often did you use each instructional feature?
2. How difficult/easy is it to use each instructional feature?
3. How inadequate/adequate was the training you received in the use of each instructional feature?
4. As presently implemented on your system, how useful is each instructional feature?
5. Based on the definitions alone and not your experience, how potentially useful is each instructional feature?

Except for Question 3, which asked SIs to rate the adequacy rather than the amount of training they received, the Phase III questionnaire was comparable to that used for Phases I and II.

For the fifth question, SIs were to assume that they had no prior knowledge of the features and to base their responses on the feature definitions alone. This question was included in order to achieve a common basis for comparison among all SIs. This was not otherwise possible because the various ATDs were not similarly equipped.

Responses to each question were indicated by checking the appropriate interval along a 7-point, successive-category rating scale. (On certain questions a 0-interval was included for indicating "not applicable.") The intervals of each scale were labeled with descriptive adjectives, such as slightly useful, fairly useful, moderately useful, extremely useful, and indispensable, in order to facilitate responding and aid in interpretation of the ratings. Additional space was provided for comments.

Procedure

The questionnaire was administered on-site to various sized (N = 5 to 10) groups of SIs. The SIs were briefed on the purpose of the investigation and copies of the questionnaire were distributed and thoroughly reviewed prior to being filled out. The questionnaire could be completed in approximately 30 minutes.

III. RESULTS

The SIs' responses to each question were coded as 0 (not applicable) to 7 (the maximum possible rating). The ratings were classified by ATD (e.g., F-4, F-15, etc.), type of training (e.g., replacement, continuation), and AIF (e.g., recorded briefing, demonstration, etc.). The resulting data matrix was unbalanced due to differences in the number of SIs and in the AIF capabilities of the various ATD sites. In most cases, this required that the data from each ATD be analyzed separately. The results of these analyses are reported elsewhere (Polzella, 1983, 1985; Polzella & Hubbard, 1985). A summary of the results follows.

General Trends

Interrelations Among the Variables

At every training site, there were clear interrelations among the ratings, as indicated by the intercorrelations between the ratings of each feature across the five questions. The observed Pearson correlation coefficients[1] ranged from -.05 to +.80; 95% of the coefficients were positive and significant. Thus, the following generalization describes reasonably well the data obtained at every site: A feature's rating on any

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[1] The Pearson correlation coefficient is a statistical measure of association that can range from -1 to 1. A value of 1 represents a perfect positive relationship; and a -1, a perfect negative or inverse relationship. A value of zero indicates no linear relation.

question can be predicted with greater-than-chance accuracy, given its rating on any other question. For example, the more useful a feature was, the more frequently it was used, the easier it was to use, the greater and more adequate was the training received in its use, and the greater was its potential training value.

Multiple linear regressions were used to determine the degree to which the frequency of AIF use could be predicted from the remaining utility and utilization ratings. Three potential predictors were evaluated: the ease of AIF use; the amount (or adequacy) of training received; and AIF training value, a composite variable representing the average of the ratings on Questions 4 (training value) and 5 (potential training value).

A separate analysis was computed for each ATD site, and the results are summarized in Table 3. Ease of use, training received, and training value, together, accounted for roughly 40% of the variability in the frequency-of-use ratings. The standardized regression coefficients (betas) associated with each variable are indications of the strength of that variable as a predictor; i.e., the larger the beta, the greater the predictability. It can be seen, for virtually every ATD, that the most important predictor of a feature's use was its training value. For TAC non-EW ATDs, ease of use, but not amount of training received, was also an important predictor. For ATC, MAC, and SAC non-EW ATDs, both ease of use and amount of training received were moderately important predictors, whereas for EW ATDs, neither ease of use nor adequacy of training received tended to be important.

Overview of the Data

An overview of the data can be obtained by examining Figures 1 through 6, in which unweighted mean ratings of the frequency of use, ease of use, training value, potential training value, amount of training received, and adequacy of training received are shown for each AIF that was surveyed. The unweighted means were calculated by averaging over the means obtained at each site. Although each unweighted mean is an unbiased average, unaffected by differences in the number of SIs that were surveyed, it is only representative of ATD sites at which the particular AIF-capability was present and/or was surveyed.

The features are grouped according to function in these figures. Briefing features are those used for briefing the student and/or SI prior to or during a training mission. Training management features permit the SI to control the structure and sequencing of tasks within a training mission. Variation of task difficulty/fidelity features permits the SI to control the difficulty of simulated missions through variations in ATD fidelity, configuration, or task load demands. Monitoring features permit the SI to monitor parameters (i.e., aircraft states) and procedures (i.e., discrete actions performed by the student in accordance with prescribed standards) at the instructor console in the form of alphanumeric and/or graphic cathode-ray tube (CRT) displays of performance data. Finally,

Table 3. Multiple Linear Regression Analyses of Frequency of AIF-use on Ease of AIF-use, Training Received by SIs, and AIF Training Value

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Multiple R	.74	.71	.55	.53	.70	.70	.65	.66	.53	.53	.66	.68	.65	.65	.50	.72	.52
Ease of Use																	
Beta	.28	.17	.16	.19	.22	.29	.15	.11	.03	-.06	.37	-.08	.29	.29	.02	.33	.32
p	.00	.00	.12	.00	.00	.00	.00	.02	.67	.52	.00	.25	.00	.00	.82	.00	.00
Training Received by SI[a]																	
Beta	.18	.16	-.02	.25	.19	.18	.24	.35	-.18	.20	.13	.03	.08	.26	.06	-.03	.12
p	.00	.00	.83	.00	.00	.00	.00	.00	.02	.03	.05	.71	.15	.00	.50	.78	.18
AIF Training Value[b]																	
Beta	.46	.52	.49	.30	.46	.40	.42	.35	.57	.45	.37	.68	.43	.26	.46	.54	.35
p	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

[a] Refers to "amount of training received" (non-electronic warfare) or "adequacy of training received" (electronic warfare).

[b] Refers to the average of "training value" and "potential training value" (non-electronic warfare) or the average of "usefulness" and "potential usefulness" (electronic warfare).

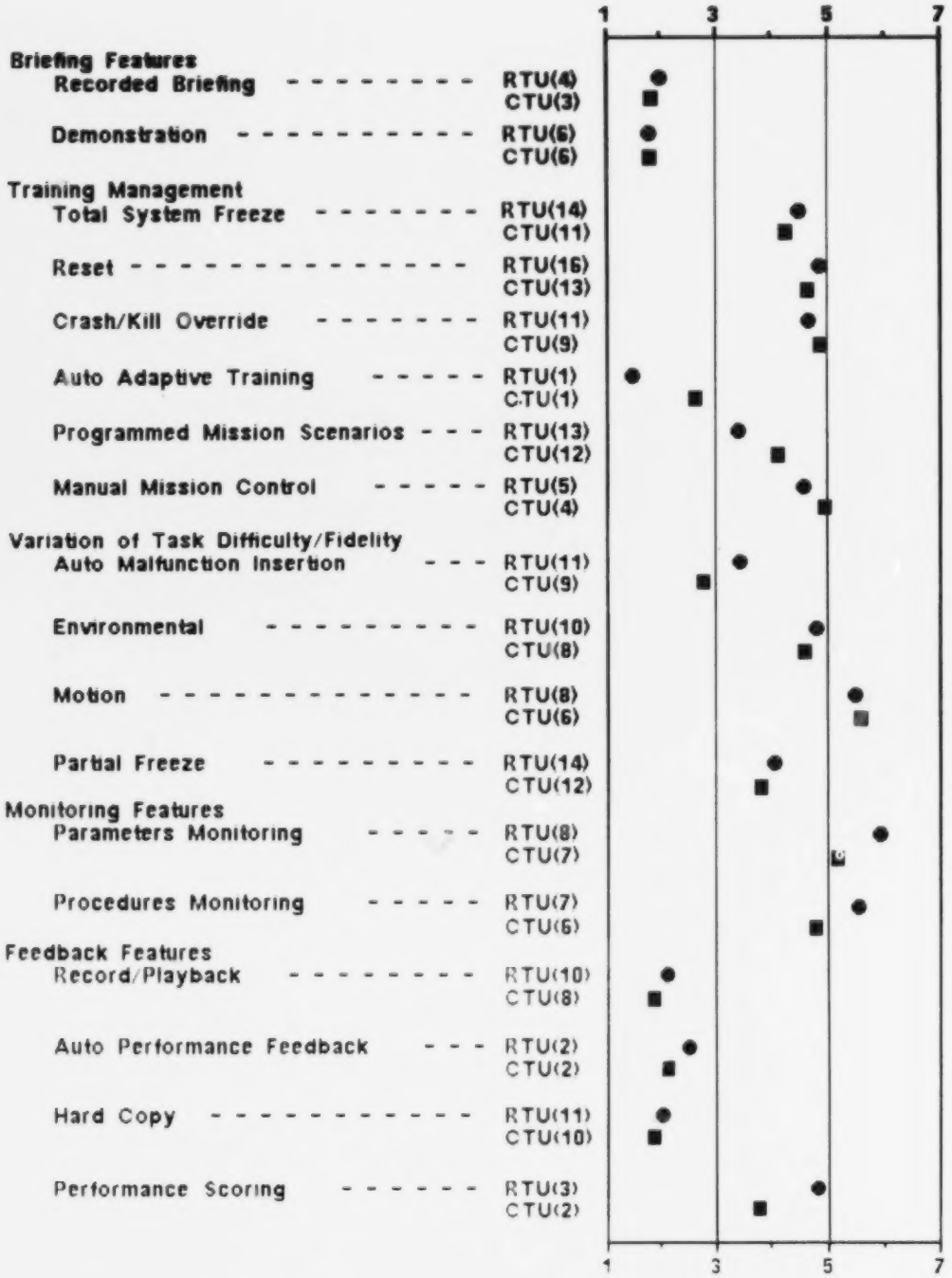

Figure 1. Frequency of AIF Use. Mean ratings of each AIF for frequency of use. Circles represent RTU means; squares, CTU means. Numbers in parentheses indicate the number of ATD sites where the respective AIF was rated.

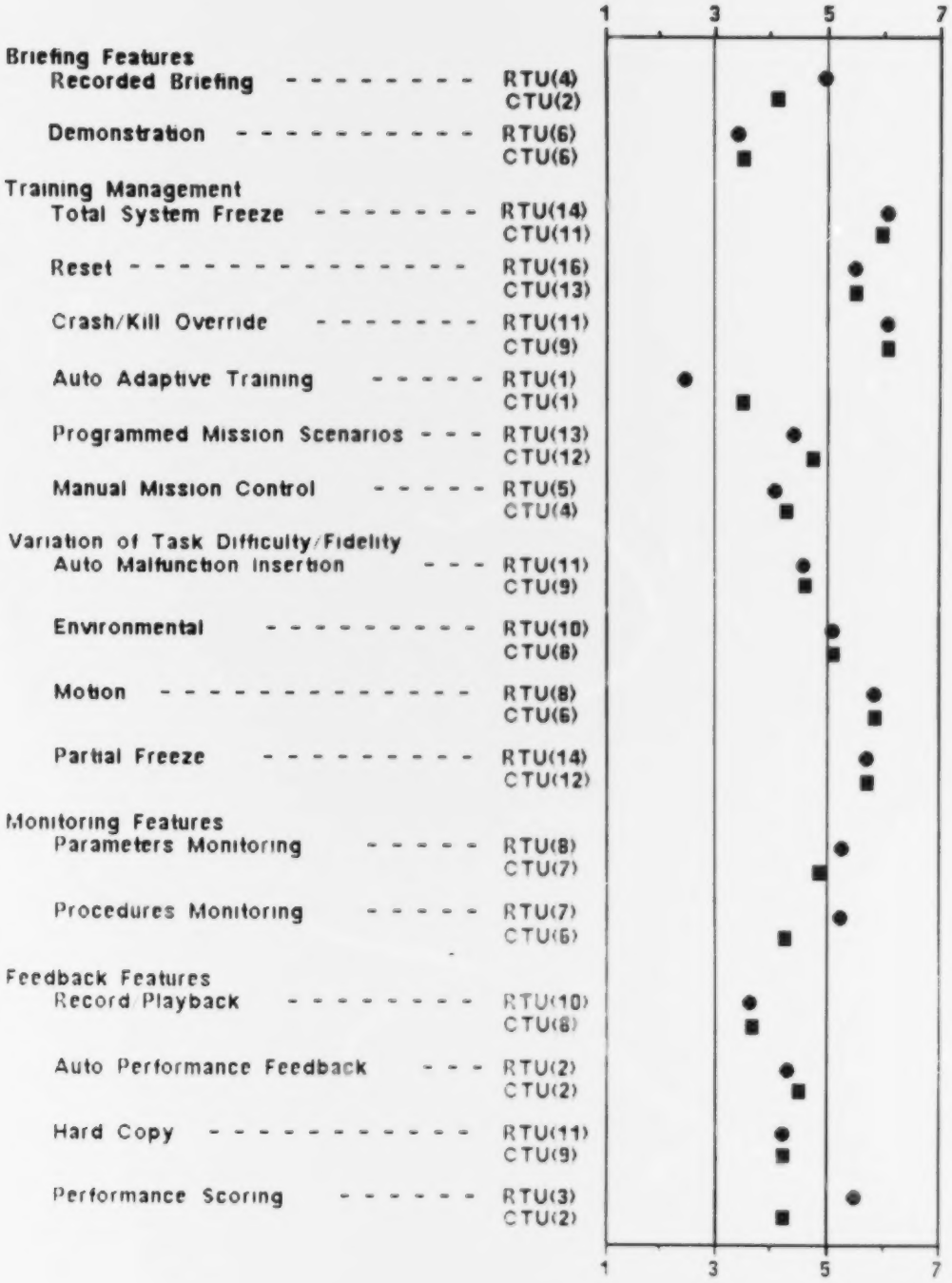

Figure 2. Ease of AIF Use. Mean ratings of each AIF for ease of use. Circles represent RTU means; squares, CTU means. Numbers in parentheses indicate the number of ATD sites where the respective AIF was rated.

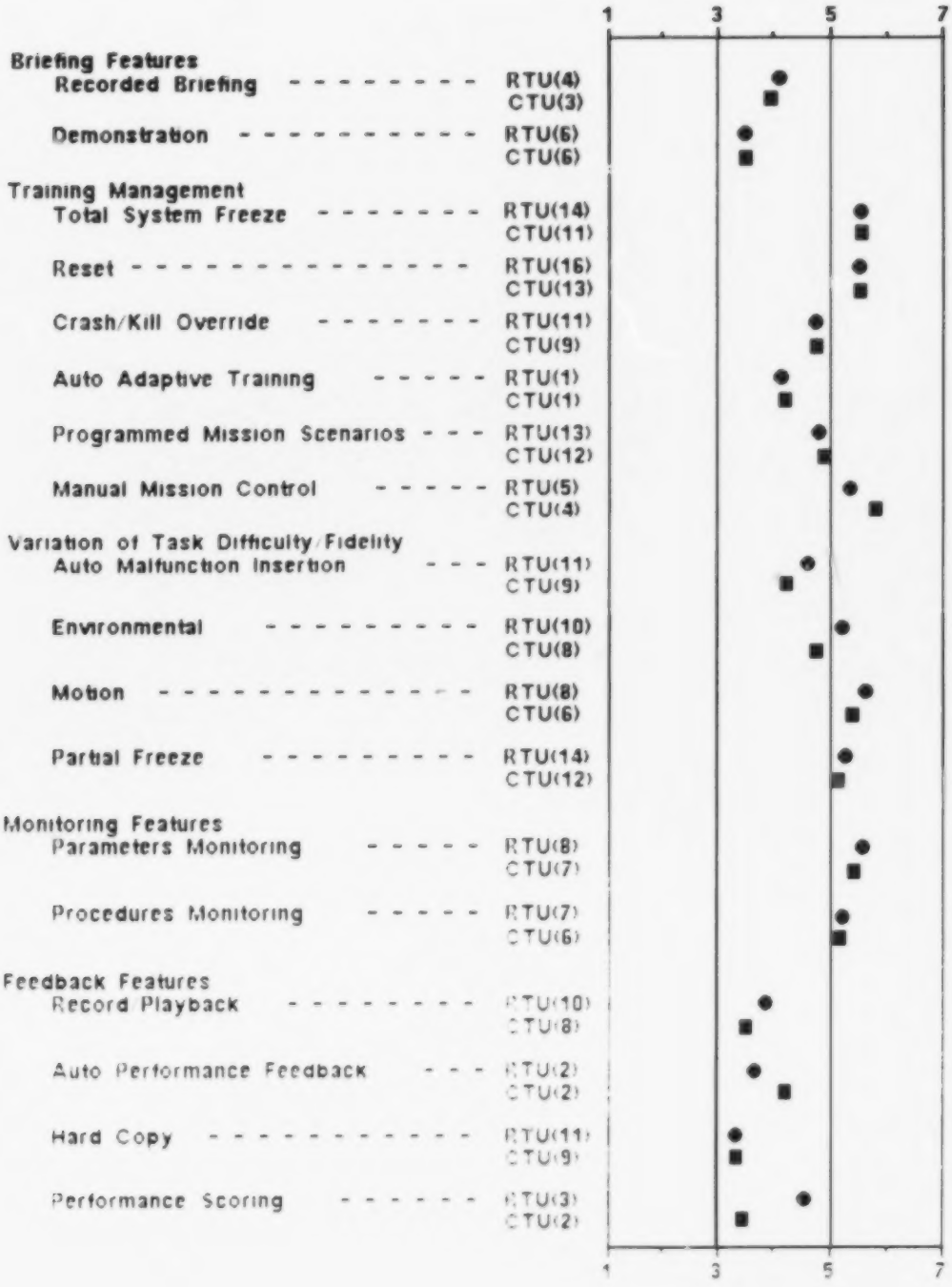

Figure 3. Training Value of AIF. Mean ratings of each AIF for training value. Circles represent RTU means; squares, CTU means. Numbers in parentheses indicate the number of ATD sites where the respective AIF was rated.

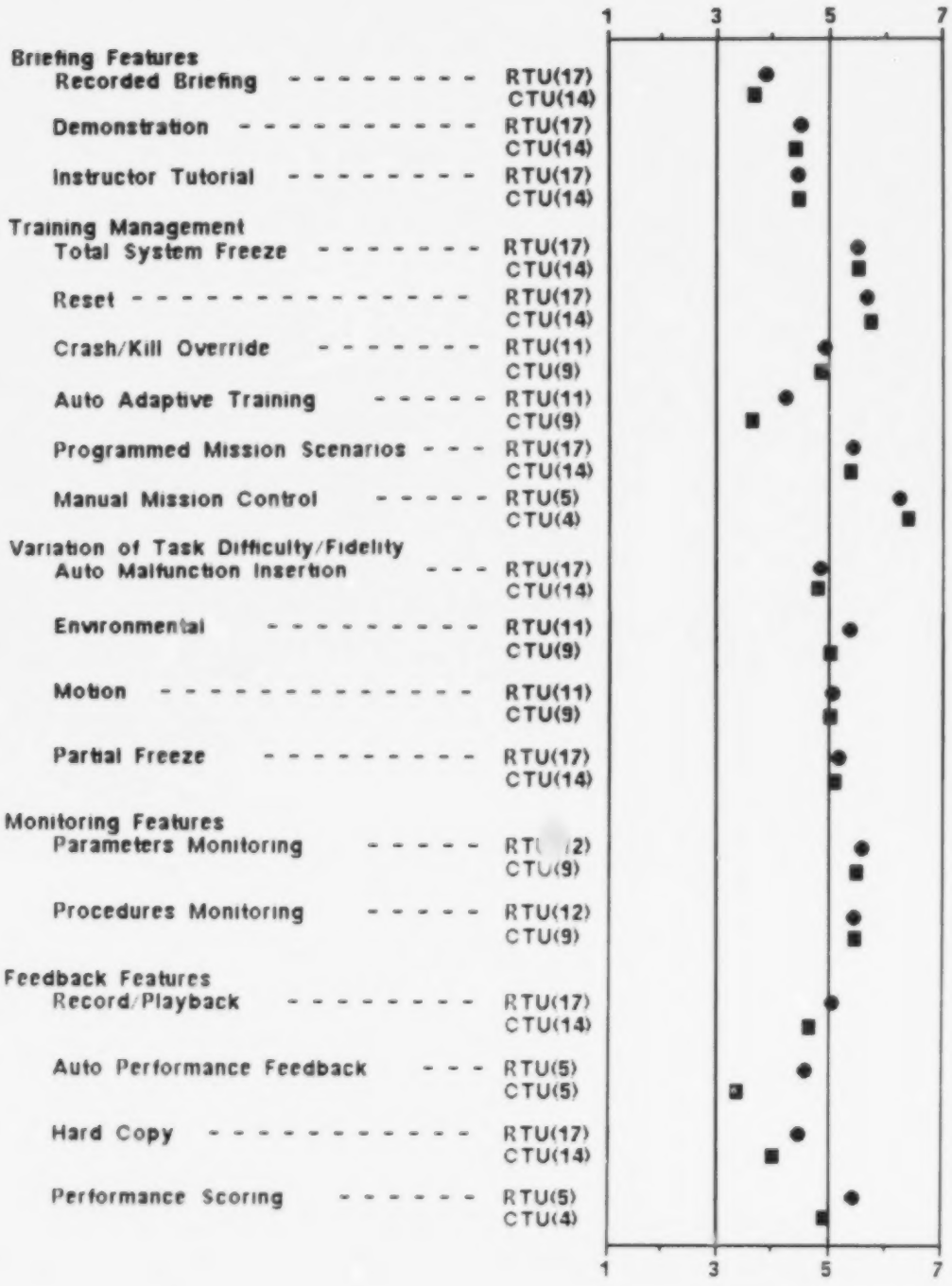

Figure 4. Potential Training Value for AIF. Mean ratings of each AIF for potential training value. Circles represent RTU means; squares, CTU means. Numbers in parentheses indicate the number of ATD sites where the respective AIF was rated.

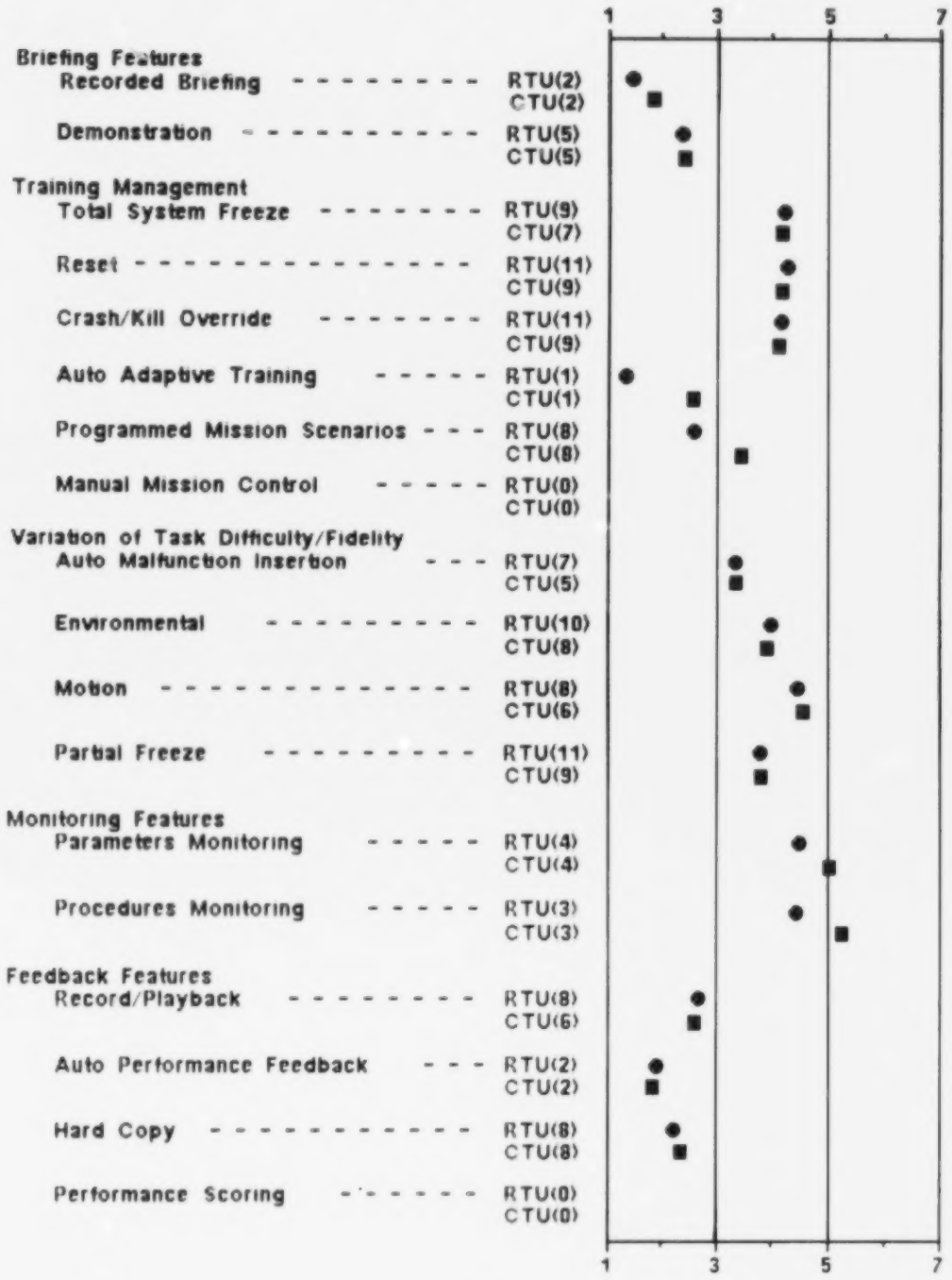

Figure 5. Amount of Training Received in AIF Use. Mean ratings of each AIF for the amount of training received. Circles represent RTU means; squares, CTU means. Numbers in parentheses indicate the number of ATD sites where the respective AIF was rated.

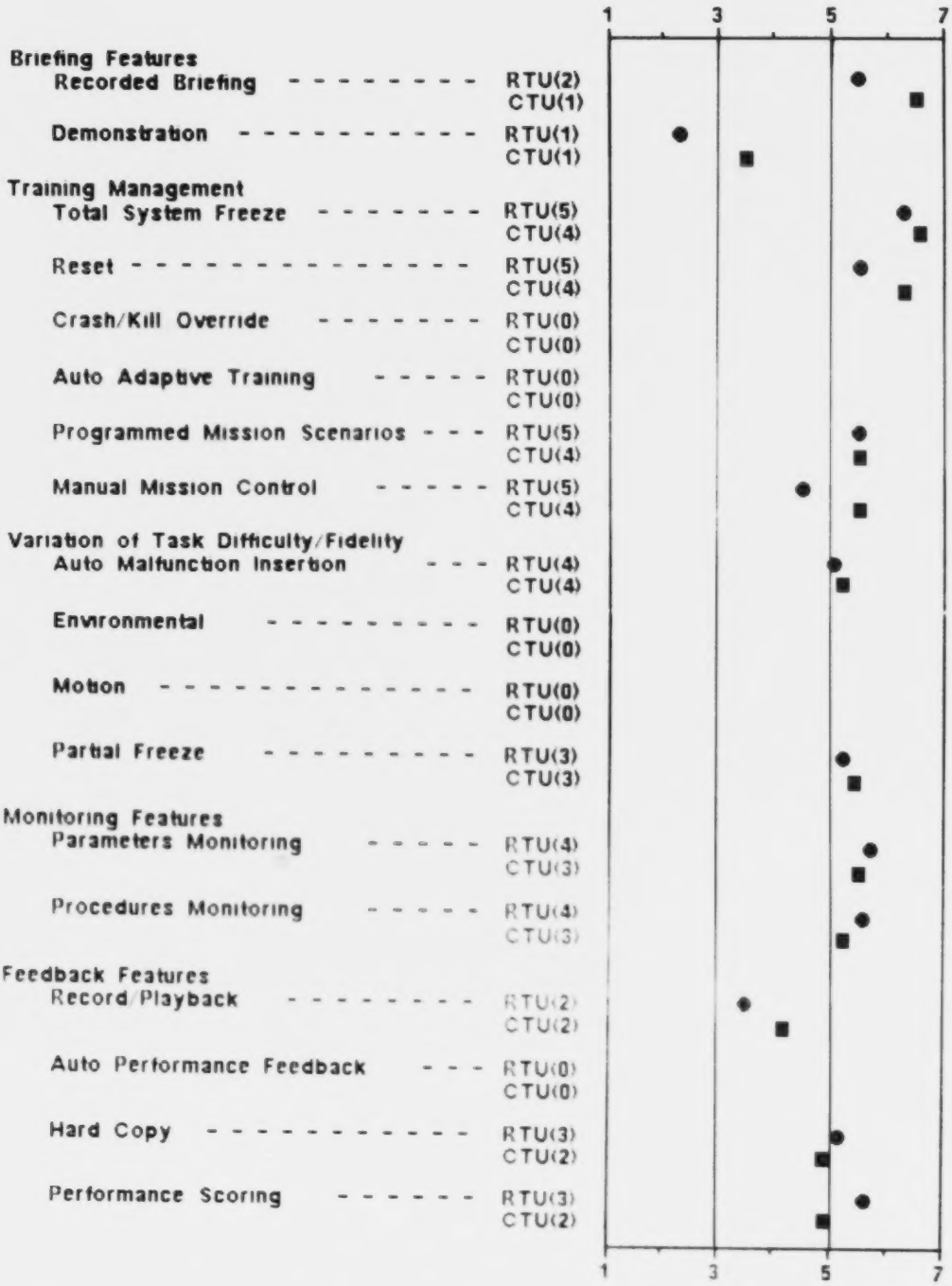

Figure 6. Adequacy of Training Received in AIF Use. Mean ratings of each AIF for adequacy of training received. Circles indicate the number of ATD sites where the respective AIF was rated.

feedback features permit the SI to provide the student with various forms of performance feedback.

Two general trends are revealed in the figures. First, training management, variation of task difficulty/fidelity, and monitoring features tended to receive the highest ratings, whereas briefing and feedback features tended to receive the lowest ratings. This trend was observed at every ATD site.

The second general trend revealed in the figures is that there were differences in the ratings of features across the two levels of training. The figures indicate that certain features tended to receive higher ratings from replacement training unit (RTU) SIs (e.g., performance scoring), whereas others tended to receive higher ratings from continuation training unit (CTU) SIs (e.g., programmed mission scenarios). However, there were many exceptions to this trend, which are noted in the sections that follow.

Utility and Utilization Ratings of Each AIF

A more detailed summary of the data is presented in the tables that follow. The tables list means and standard deviations of the SIs' ratings of the frequency of use, ease of use, amount of training received, adequacy of training received, training value, and potential training value for each of the 19 AIFs that were surveyed, respectively. The data are tabulated according to MAJCOM, and statistics are listed separately for the two levels of training and for every ATD having the particular AIF capability (assuming that it was included on the given questionnaire). ATC ATDs include T-50, T-51, and T-5 (electronic warfare, EW), RTU only. MAC ATDs include C-5/C-141, C-130, and CH-3/HH-53, RTU and CTU. SAC ATDs include FB-111A, FB-111A (EW), T-4 (EW), and B-52 WST (EW), RTU and CTU. TAC ATDs include F-4E/F-4G, F-4G (EW), F-15, A-10, A-10 (EW), E-3A Flight Simulator, and E-3A Mission Simulator, RTU and CTU. Note that the data from some of the training sites were combined (e.g., C-5/C-141, CH-3/HH-53, and F-4E/F-4G). It seemed appropriate to combine these data since the respective training missions were highly similar and the comparable mean ratings were nearly identical.

Briefing Features

Recorded Briefing (Table 4)

Incidence. Recorded briefing was surveyed at every ATD site; it was available for use on only four devices: T-5, T-4, A-10, and E-3A mission simulator.

Utility and utilization. Except for T-5 SIs, who regularly used recorded briefing, the majority of instructors never used the feature; and several were not even aware that the capability existed. Instructors' written comments suggested a preference for informal briefings, which could be adapted to the particular needs of individual students and instructors.

Table 4. Recorded Briefing

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			4.2 (2.1)						1.2 (0.4)					1.2 (0.8)			1.5 (0.9)
Frequency of Use-C									2.5 (1.0)					1.0 (0.0)			1.8 (1.3)
Ease of Use-R			5.8 (1.2)						4.4 (1.7)					5.0 (0.0)			4.6 (1.5)
Ease of Use-C									4.8 (1.3)					- -			3.5 (2.1)
Amount of Training Received-R														1.2 (0.8)			1.3 (0.8)
Amount of Training Received-C														1.3 (1.2)			2.2 (1.8)
Adequacy of Training Received-R			6.3 (1.0)						4.4 (2.4)								
Adequacy of Training Received-C									6.5 (1.1)								
Training Value-R			5.6 (1.4)						2.1 (1.2)					5.2 (1.5)			3.6 (2.1)
Training Value-C									6.0 (0.8)					2.5 (0.7)			3.3 (0.6)
Potential Training Value-R	4.7 (2.0)	5.0 (1.5)	4.9 (1.8)	3.9 (1.6)	3.7 (1.5)	3.6 (1.8)	3.3 (1.8)	3.9 (1.8)	3.0 (1.1)	3.8 (1.6)	3.3 (1.5)	3.5 (2.0)	3.9 (1.4)	3.7 (1.6)	4.1 (1.8)	5.0 (1.0)	4.6 (1.9)
Potential Training Value-C				4.5 (1.7)	4.5 (1.4)	3.0 (1.8)	3.3 (1.5)	4.2 (1.7)	4.9 (1.4)	4.2 (1.8)	3.6 (1.4)	2.9 (1.7)	2.7 (1.4)	3.3 (1.3)	2.9 (1.7)	1.5 (0.7)	4.4 (1.5)

Comparisons across MAJCOMs and levels of training. The potential utility of recorded briefing tended to be highest for ATC ATDs and lowest for TAC ATDs. For six of the seven TAC ATDs (all except the F-4E/F-4G), the RTU SIs' potential training value ratings were higher than those of the CTU SIs. (This difference was significant for the E-3A flight simulator.) In contrast, for three of the four SAC ATDs (all except the FB-111A), the CTU SIs' potential training value ratings were higher than those of the RTU SIs.

Demonstration (Table 5)

Incidence. Demonstration was surveyed at every ATD site. It was available for use on six devices: C-130, CH-3/HH-53, FB-111A, A-10, A-10 (EW), and E-3A mission simulator.

Utility and utilization. The ratings of the demonstration feature were among the lowest ratings given for any feature. There were two major complaints at each site: First, implementing the feature was time-consuming and often unreliable. Second, an enormous effort was required to update and maintain current scenarios through software development, which resulted in an insufficient number of demos to meet training requirements.

Comparisons across MAJCOMs and levels of training. There were no significant differences in utility and utilization across MAJCOMs. The E-3A flight simulator RTU SIs rated demonstration higher in potential training value than did the CTU SIs; however, there were no other significant differences across the two levels of training.

Instructor Tutorial (Table 6)

Incidence. Instructor tutorial was surveyed at every ATD site; however, none of the ATDs included this capability. This feature differed from the other AIFs surveyed in that its purpose was the instruction of SIs in the operation of the ATD.

Utility and utilization. The potential training value ratings were all in the moderate range of the scale. The instructors' written comments suggested that they prefer "hands-on" experience and/or "face-to-face" tutorials on the operation of the instructor's console.

Comparison across MAJCOMs and levels of training. The potential training ratings were statistically equivalent across the MAJCOMs and between the two levels of training.

Training Management Features

Total System Freeze and Reset (Tables 7 and 8)

Incidence. Total system freeze and reset were surveyed at every ATD site. Total system freeze was available for use on every device except the F-4E/F-4G, F-15, and E-3A flight simulator (but it was present on the E-3A mission simulator). Reset was available on every device except the E-3A mission simulator.

Table 5. Demonstration

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R					1.6 (1.0)	1.5 (1.5)	1.7 (0.8)							1.8 (1.3)	1.1 (0.0)		3.3 (2.3)
Frequency of Use-C					2.4 (1.6)	1.6 (1.3)	1.4 (0.7)							1.2 (0.4)	1.1 (0.3)		3.0 (2.0)
Ease of Use-R					4.1 (1.1)	4.5 (2.1)	2.0 (1.0)							3.6 (1.8)	2.2 (1.0)		4.8 (1.5)
Ease of Use-C					4.5 (1.1)	3.8 (1.9)	2.6 (1.2)							4.5 (0.7)	3.0 (1.6)		4.0 (1.4)
Amount of Training Received-R					2.4 (1.1)	1.5 (1.2)	2.3 (1.5)							2.2 (1.4)			3.0 (1.9)
Amount of Training Received-C					3.2 (1.2)	1.8 (1.2)	2.0 (1.4)							1.3 (0.9)			3.7 (2.1)
Adequacy of Training Received-R															2.2 (1.2)		
Adequacy of Training Received-C															3.5 (1.8)		
Training Value-R					3.4 (1.5)	3.0 (2.3)	3.3 (0.6)							3.8 (1.7)	1.7 (0.6)		5.3 (0.9)
Training Value-C					3.4 (1.8)	2.7 (1.7)	3.9 (1.9)							3.3 (1.2)	2.2 (1.3)		5.0 (0.0)
Potential Training Value-R	4.6 (1.6)	5.5 (1.2)	5.0 (1.4)	4.4 (1.5)	4.1 (1.3)	4.5 (2.0)	3.8 (1.9)	5.5 (1.5)	4.6 (1.7)	5.2 (1.3)	4.1 (1.7)	4.4 (1.8)	4.5 (1.5)	4.5 (1.6)	3.7 (2.1)	5.2 (0.8)	5.1 (1.8)
Potential Training Value-C				4.6 (1.6)	4.7 (1.5)	4.3 (1.9)	4.2 (1.5)	4.7 (1.6)	5.9 (1.2)	4.5 (1.9)	4.5 (1.6)	4.6 (1.7)	3.6 (1.8)	4.5 (1.6)	3.6 (1.6)	1.5 (0.7)	5.6 (1.1)

Table 6. Instructor Tutorial

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R																	
Frequency of Use-C																	
Ease of Use-R																	
Ease of Use-C																	
Amount of Training Received-R																	
Amount of Training Received-C																	
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R																	
Training Value-C																	
Potential Training Value-R	4.0 (1.6)	4.4 (1.5)	4.2 (1.9)	4.3 (1.5)	3.8 (2.2)	4.5 (1.4)	3.8 (1.9)	4.6 (1.5)	4.0 (1.7)	4.3 (1.7)	4.6 (1.6)	4.4 (1.4)	4.3 (1.3)	5.0 (1.4)	4.8 (1.6)	4.6 (1.5)	4.4 (2.2)
Potential Training Value-C				4.2 (1.5)	3.5 (1.8)	3.9 (2.0)	4.2 (1.6)	4.6 (1.6)	3.8 (1.6)	4.8 (1.9)	5.2 (1.8)	4.4 (1.4)	4.1 (1.5)	4.8 (1.1)	3.8 (1.7)	6.5 (0.7)	4.8 (1.1)

Table 7. Total System Freeze

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	5.7 (1.4)	6.1 (0.9)	5.3 (2.1)	3.1 (1.4)	4.7 (1.3)	4.5 (1.0)	4.3 (1.5)	3.8 (1.1)	6.0 (0.9)	5.1 (0.6)		4.2 (1.5)		4.5 (1.5)	4.9 (0.9)		1.3 (0.6)
Frequency of Use-C				3.4 (1.5)	4.6 (1.6)	6.1 (0.7)	4.4 (1.5)	4.3 (1.2)	6.1 (1.1)	4.7 (1.4)		4.2 (1.1)		3.0 (1.9)	5.3 (0.8)		1.2 (0.4)
Ease of Use-R	6.7 (0.6)	6.8 (0.4)	6.2 (0.4)	6.0 (0.9)	6.2 (0.9)	6.6 (0.5)	6.7 (0.5)	6.0 (1.1)	6.2 (0.5)	6.1 (0.6)		6.0 (0.4)		5.7 (0.8)	6.0 (0.7)		4.7 (1.9)
Ease of Use-C				5.9 (0.9)	6.3 (0.9)	6.4 (0.6)	6.6 (0.7)	6.1 (0.8)	6.4 (0.5)	6.7 (0.5)		6.3 (0.5)		5.8 (1.3)	6.1 (0.3)		2.7 (2.1)
Amount of Training Received-R	4.6 (1.7)	5.6 (1.3)		3.7 (1.5)	4.6 (1.3)	4.5 (1.2)	4.2 (1.2)	4.1 (1.1)						4.5 (1.0)			1.5 (0.9)
Amount of Training Received-C				3.6 (1.5)	4.8 (1.0)	5.4 (1.4)	4.3 (1.5)	4.4 (1.4)						3.8 (1.9)			2.0 (1.1)
Adequacy of Training Received-R			6.6 (0.5)						6.6 (0.7)	6.3 (1.0)		5.6 (1.1)			6.3 (0.9)		
Adequacy of Training Received-C									6.9 (0.4)	6.4 (0.9)		6.6 (0.7)			6.6 (0.6)		
Training Value-R	6.0 (0.8)	6.1 (1.0)	6.3 (1.3)	4.4 (1.4)	5.6 (0.9)	6.0 (1.2)	5.5 (1.6)	5.5 (1.1)	6.6 (0.8)	6.6 (0.7)		5.4 (1.0)		5.2 (1.2)	6.1 (0.9)		3.2 (1.6)
Training Value-C				5.2 (1.3)	5.6 (1.5)	6.2 (0.9)	6.0 (1.2)	5.9 (1.1)	6.7 (0.5)	6.0 (2.0)		6.3 (0.7)		5.0 (1.3)	6.6 (0.6)		3.3 (1.5)
Potential Training Value-R	6.1 (1.1)	6.2 (0.8)	6.5 (0.8)	4.7 (1.3)	5.8 (0.9)	6.3 (1.2)	5.5 (1.4)	5.9 (1.0)	6.6 (0.8)	6.7 (0.5)	2.6 (2.0)	5.8 (1.1)	4.0 (2.1)	5.3 (1.3)	6.2 (0.9)	5.6 (0.5)	3.6 (1.5)
Potential Training Value-C				5.6 (0.9)	5.8 (1.0)	6.2 (1.5)	5.9 (1.0)	6.0 (0.9)	6.4 (0.9)	6.7 (0.5)	4.2 (2.1)	6.5 (0.7)	5.3 (1.0)	4.9 (1.7)	6.5 (0.9)	2.0 (1.4)	3.8 (1.6)

Table 8. Reset

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	5.6 (1.3)	6.2 (0.8)	4.5 (1.5)	4.5 (1.9)	5.7 (1.0)	4.3 (1.3)	5.5 (0.8)	4.0 (1.3)	5.4 (1.0)	4.0 (1.5)	5.2 (1.1)	4.0 (1.4)	4.8 (1.6)	5.0 (1.2)	3.3 (1.9)	6.2 (0.8)	
Frequency of Use-C				4.3 (1.9)	5.5 (1.3)	5.5 (1.1)	4.5 (1.4)	5.1 (1.0)	5.5 (1.2)	4.2 (1.2)	5.0 (1.3)	4.9 (0.9)	2.8 (2.0)	4.3 (1.4)	5.1 (0.6)	4.7 (1.2)	
Ease of Use-R	5.9 (0.8)	6.0 (0.7)	5.9 (0.5)	5.4 (0.8)	5.5 (1.0)	5.2 (0.9)	6.2 (0.8)	4.9 (1.6)	5.7 (0.9)	5.1 (1.1)	5.9 (1.2)	5.5 (0.9)	5.3 (1.0)	5.1 (0.7)	4.7 (1.3)	6.4 (0.9)	
Ease of Use-C				5.5 (1.0)	5.9 (0.8)	5.6 (0.8)	5.6 (1.1)	5.7 (1.0)	5.9 (0.4)	5.3 (1.4)	6.0 (1.1)	6.0 (0.9)	4.7 (1.3)	5.4 (0.9)	5.9 (0.7)	5.7 (0.6)	
Amount of Training Received-R	4.2 (1.1)	5.1 (0.9)		3.7 (1.7)	4.6 (1.2)	4.1 (1.0)	4.2 (1.5)	3.6 (1.2)			3.7 (1.4)		4.0 (1.4)	4.3 (1.0)		4.4 (1.5)	
Amount of Training Received-C				3.6 (1.8)	4.8 (0.8)	5.0 (1.6)	4.3 (1.2)	4.3 (1.4)			4.0 (1.1)		1.9 (1.1)	4.2 (1.3)		4.3 (2.1)	
Adequacy of Training Received-R			6.1 (1.3)						6.6 (0.7)	4.5 (1.7)		5.2 (1.5)			5.1 (1.9)		
Adequacy of Training Received-C									6.5 (0.8)	6.0 (1.5)		6.4 (0.8)			6.2 (1.1)		
Training Value-R	5.9 (0.9)	6.3 (0.8)	6.4 (0.8)	5.2 (1.2)	5.5 (1.0)	5.0 (1.3)	5.5 (1.2)	4.6 (1.6)	6.3 (1.2)	4.9 (1.8)	5.4 (1.1)	5.5 (0.9)	5.6 (0.8)	5.2 (1.2)	4.1 (1.5)	5.8 (0.8)	
Training Value-C				5.5 (1.1)	6.0 (1.2)	5.6 (1.3)	5.0 (1.6)	5.4 (1.1)	6.6 (0.5)	5.7 (1.8)	5.4 (1.3)	6.1 (1.0)	3.8 (1.4)	5.3 (1.4)	5.8 (1.3)	5.0 (0.0)	
Potential Training Value-R	6.3 (0.7)	6.2 (0.7)	6.6 (0.6)	5.6 (1.1)	5.4 (1.6)	5.7 (1.0)	5.8 (1.2)	5.3 (0.9)	6.0 (1.1)	6.1 (0.6)	5.5 (0.9)	6.0 (0.8)	5.4 (1.0)	5.2 (1.2)	5.1 (1.8)	5.8 (0.4)	3.6 (1.8)
Potential Training Value-C				5.7 (0.8)	6.0 (1.0)	5.5 (1.7)	5.6 (1.2)	5.7 (0.9)	6.5 (0.5)	6.2 (1.6)	5.4 (1.2)	6.4 (0.6)	4.8 (1.9)	5.8 (0.9)	6.2 (0.9)	5.5 (2.1)	5.4 (0.9)

Utility and utilization. It makes sense to consider total system freeze and reset together, since they were so often used in conjunction. SIs used total system freeze when they wished to temporarily suspend the training mission in order to provide the student with instruction or feedback. They then used reset in order to restore the mission. There were few problems associated with the use of these features. The frequency- and ease-of-use ratings indicated that these features tended to be implemented very easily and with moderate regularity. The only exceptions occurred at sites in which (a) it was necessary to reinitialize the ATD in order to resume training following the use of total system freeze (e.g., E-3A mission simulator), or (b) the use of reset was not sufficient to permit resumption of the mission from the point at which it had been suspended (e.g., F-15 simulator).

Comparisons across MAJCOMs and levels of training. The EW SIs' utility ratings of total system freeze and reset were high, and did not differ across the MAJCOMs. There was more variability in the non-EW SIs' ratings; utility was highest for ATC SIs, lowest for TAC SIs.

On several ATDs, there were significant differences in utility and utilization across the two levels of training. Most of these differences showed higher ratings by RTU SIs. On the F-15 ATD, the RTU SIs used reset more frequently than did the CTU SIs. They also received more training in the use of reset and rated the feature as having greater training value. On the A-10 ATD, the RTU SIs used total system freeze more often than did the CTU SIs; and on the E-3A flight simulator, the RTU SIs rated the feature higher in potential training value than did the CTU SIs. However, on the C-5/C-141 ATD, the CTU SIs assigned higher training value ratings to total system freeze than did the RTU SIs.

Crash/Kill Override (Table 9)

Incidence. Crash/kill override was surveyed at every non-EW ATD site. It was available for use on all non-EW devices.

Utility and utilization. We can account for the generally high ratings by considering that although crash/kill override is more properly viewed as a variation of the task difficulty feature, it was more often used for training management. If "crashes" or "kills" were permitted to occur, a tedious reinitialization of the ATD would typically be required. Thus, the feature was used, more often than not, in order to avoid the loss of instruction time.

Comparisons across MAJCOMs and levels of training. "Crashes" were most often permitted (i.e., crash/kill override was not activated) on the ATC ATDs (viz., T-50, T-51) and on TAC's E-3A mission simulator. On the C-5/C-141 ATD, the RTU SIs used the feature more often than did the CTU SIs; and on the F-15 ATD, the RTU SIs rated the feature as easier to use than did the CTU SIs.

Table 9. Crash and/or Kill Override

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	3.6 (1.4)	3.8 (1.4)		5.5 (2.1)	5.1 (1.4)	5.1 (2.0)	4.8 (1.3)				6.4 (1.1)		5.6 (1.7)	4.6 (2.1)		4.6 (1.8)	3.1 (2.4)
Frequency of Use-C				4.4 (2.2)	5.0 (1.4)	5.4 (1.6)	5.5 (1.4)				6.5 (0.7)		5.1 (1.3)	3.8 (1.9)		5.0 (1.7)	3.0 (2.3)
Ease of Use-R	5.7 (1.2)	5.8 (1.3)		6.3 (0.9)	6.0 (1.0)	6.5 (0.7)	6.3 (0.8)				6.5 (0.7)		6.7 (0.7)	5.9 (1.1)		5.8 (1.8)	5.8 (1.3)
Ease of Use-C				6.1 (1.0)	6.3 (0.9)	6.1 (0.8)	6.2 (1.0)				6.5 (0.7)		5.8 (0.9)	5.6 (1.4)		5.3 (2.1)	6.0 (1.0)
Amount of Training Received-R	3.7 (1.3)	4.0 (1.3)		3.6 (1.6)	4.7 (1.5)	4.1 (1.8)	4.3 (1.2)				3.2 (1.8)		4.3 (1.1)	4.2 (1.5)		5.4 (1.5)	2.8 (2.1)
Amount of Training Received-C				3.6 (1.5)	4.8 (1.0)	4.8 (1.8)	4.5 (1.4)				3.8 (1.3)		3.8 (1.5)	3.8 (1.6)		3.3 (2.1)	2.7 (2.0)
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R	4.4 (1.5)	4.4 (1.5)		4.6 (1.7)	5.3 (1.1)	5.1 (1.4)	4.7 (0.5)				5.4 (1.5)		5.3 (1.3)	4.9 (1.6)		5.4 (1.5)	4.7 (2.0)
Training Value-C				4.8 (1.7)	5.1 (1.1)	4.8 (1.9)	5.1 (1.6)				4.8 (1.5)		4.6 (1.2)	5.0 (1.4)		4.7 (0.6)	4.3 (0.6)
Potential Training Value-R	4.8 (1.4)	4.8 (1.1)		4.9 (1.5)	5.5 (1.1)	5.5 (1.3)	5.0 (1.7)				5.5 (1.4)		5.4 (1.4)	4.6 (1.7)		5.4 (1.1)	3.6 (2.1)
Potential Training Value-C				5.0 (1.7)	5.8 (0.8)	4.8 (1.8)	5.5 (1.3)				5.2 (1.8)		4.7 (1.4)	4.8 (1.7)		4.0 (0.0)	3.4 (1.7)

Automated Adaptive Training (Table 10)

Incidence. Automated adaptive training was surveyed at every non-EW ATD site; it was available for use only on the F-4E ATD.

Utility and utilization. Utilization of automated adaptive training was minimal. The F-4E SIs' ratings of the frequency of use, ease of use, and amount of training received were lower than 95% of the comparable ratings of the other training management features. According to the SIs who used automated adaptive training (the majority did not use it and more than 20% were unaware of its availability), there were two major problems with the feature: The first was that "it takes the instructor out of the loop"; the second was that it could be applied only at certain points during a mission.

Comparisons across the MAJCOMs and levels of training. The potential training value ratings were statistically equivalent across the MAJCOMs and between the two levels of training, with one exception: The E-3A flight simulator RTU SIs' mean rating was significantly higher than that of the CTU SIs.

Programmed Mission Scenarios and Manual Mission Control (Tables 11 and 12)

Incidence. Programmed mission scenarios were surveyed at every ATD site. They were available for use on all but the T-50, T-51, C-5/C-141, and CH-3/HH-53 ATDs. Manual mission control was surveyed during the EW phase of the project. Data were collected from each of the EW trainers except the FB-111A.

Utility and utilization. SIs' ratings of the utility and utilization of programmed mission scenarios varied greatly across training devices. For example, in non-EW applications, frequency of use ranged from 1.0 (A-10 ATD, RTU) to 6.0 (E-3A flight simulator, CTU). In general, the most favorable ratings were obtained from the T-5, T-4, and B-52 WST SIs.

There were two important factors that limited the use of programmed mission scenarios. First, a typical simulated mission consisted of a long and complex sequence of events, and the programming of scenarios was thus a tedious and difficult task. Not surprisingly, there was an insufficient number of scenarios to accomplish training at most sites. Those that were available were frequently characterized as "unreliable," "limited," or "outdated." Second, approximately 25% of the C-130, F-4E/F-4G, F-15, and A-10 SIs commented that they preferred the increase in instructional flexibility afforded by manual mission control. Unfortunately, ratings of manual mission control were only obtained from EW SIs, and these ratings closely matched those of programmed mission scenarios, with one exception: T-5 SIs greatly preferred programmed to manual scenarios.

Table 10. Automated Adaptive Training

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R											1.4 (0.8)						
Frequency of Use-C											2.7 (1.5)						
Ease of Use-R											2.4 (1.1)						
Ease of Use-C											3.5 (0.7)						
Amount of Training Received-R											1.3 (0.6)						
Amount of Training Received-C											2.7 (2.1)						
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R											4.0 (0.9)						
Training Value-C											4.3 (1.5)						
Potential Training Value-R	4.1 (2.0)	4.0 (1.1)		3.8 (1.8)	3.5 (2.0)	3.2 (2.0)	4.3 (2.0)				4.6 (1.3)		4.2 (1.7)	4.0 (1.9)		4.4 (1.7)	5.0 (1.9)
Potential Training Value-C				4.2 (1.9)	3.7 (2.2)	3.6 (2.0)	4.7 (1.6)				4.0 (1.0)		3.6 (1.5)	3.7 (1.4)		1.0 (0.0)	3.8 (1.9)

Table 11. Programmed Mission Scenarios

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			6.4 (1.1)		2.0 (1.9)		3.5 (2.5)	3.7 (2.1)	5.9 (1.4)	5.1 (2.1)	2.1 (2.1)	3.0 (1.8)	2.1 (1.2)	1.0 (0.2)	4.3 (2.2)	1.4 (0.9)	3.4 (1.8)
Frequency of Use-C					1.5 (0.7)		5.1 (1.8)	5.4 (1.7)	6.2 (1.2)	6.7 (0.8)	3.3 (2.2)	4.1 (1.7)	4.1 (1.7)	1.5 (0.8)	3.0 (1.7)	6.0 (1.0)	3.5 (1.4)
Ease of Use-R			6.2 (1.1)		4.7 (1.1)		4.2 (2.4)	4.4 (1.3)	6.0 (1.2)	6.1 (1.3)	2.9 (1.5)	5.7 (1.2)	4.9 (1.4)	1.0 (0.0)	4.9 (2.0)	3.0 (0.0)	3.7 (1.8)
Ease of Use-C					5.2 (1.5)		4.0 (1.3)	4.5 (1.4)	5.9 (2.1)	6.7 (0.5)	4.1 (0.9)	5.9 (1.1)	4.7 (1.1)	2.8 (1.7)	4.5 (1.6)	5.0 (1.4)	4.2 (1.3)
Amount of Training Received-R					2.9 (1.8)		3.3 (2.1)	3.1 (1.4)			1.8 (1.8)		3.0 (1.8)	1.3 (0.9)		2.2 (2.7)	2.9 (1.7)
Amount of Training Received-C					3.5 (1.4)		3.3 (1.9)	4.7 (1.6)			2.6 (1.6)		2.8 (1.4)	2.3 (1.6)		3.7 (0.6)	4.0 (1.3)
Adequacy of Training Received-R			6.0 (1.6)						6.3 (1.0)	5.4 (1.8)		5.0 (1.3)			5.0 (1.7)		
Adequacy of Training Received-C									6.5 (0.8)	5.8 (1.6)		5.6 (1.6)			4.0 (1.8)		
Training Value-R			6.6 (0.7)		4.8 (1.6)		3.8 (2.4)	4.6 (1.7)	6.4 (0.7	5.8 (1.4)	4.4 (1.7)	4.5 (2.0)	4.9 (1.4)	2.8 (1.2)	3.6 (2.1)	4.0 (0.0)	4.6 (2.1)
Training Value-C					3.7 (1.8)		4.6 (1.6)	5.5 (1.4)	6.8 (0.5)	6.2 (0.8)	5.0 (1.4)	5.1 (1.4)	5.4 (1.0	4.2 (1.2)	3.2 (1.4)	4.7 (1.2)	5.0 (0.6)
Potential Training Value-R	4.8 (1.8)	4.3 (1.0)	6.4 (0.9)	4.3 (1.6)	5.1 (1.6)	4.5 (2.3)	5.0 (1.7)	5.5 (1.5)	6.4 (0.7)	6.8 (0.4)	4.9 (1.5)	5.4 (1.2)	5.2 (1.5	4.3 (1.9)	5.5 (1.5)	5.8 (0.4)	6.1 (1.3)
Potential Training Value-C				4.6 (1.4)	4.9 (2.1)	4.5 (1.9)	5.2 (1.4)	5.7 (1.3)	6.8 (0.5)	6.7 (0.8)	5.0 (1.7)	5.4 (1.3)	5.6 (1.3)	5.0 (1.1)	4.8 (1.4)	4.0 (1.4)	4.8 (1.3)

Table 12. Manual Mission Control

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			1.6 (0.8)						6.0 (1.1)	5.8 (1.6)		6.5 (0.7			3.5 (2.4)		
Frequency of Use-C									6.1 (0.8)	5.3 (0.8)		5.6 (1.2)			3.1 (2.3)		
Ease of Use-R			3.9 (1.1)						4.7 (1.1)	4.1 (0.9)		4.2 (1.0)			2.9 (1.7)		
Ease of Use-C									6.0 (0.5)	4.3 (1.4)		4.3 (1.1)			2.6 (1.0)		
Amount of Training Received-R																	
Amount of Training Received-C																	
Adequacy of Training Received-R			3.2 (1.4)						6.2 (1.1)	5.0 (1.8)		4.9 (1.5)			3.8 (1.7)		
Adequacy of Training Received-C									6.4 (0.5)	6.2 (1.0)		5.5 (1.7)			4.0 (1.8)		
Training Value-R			2.9 (1.6)						6.7 (0.6)	6.6 (0.7)		6.3 (1.1)			4.0 (2.1)		
Training Value-C									6.6 (0.5)	6.5 (0.8)		6.4 (0.8)			3.7 (1.8)		
Potential Training Value-R			4.5 (1.6)						6.6 (0.6)	7.0 (0.0)		6.4 (0.7)			6.2 (0.8)		
Potential Training Value-C									6.9 (0.4)	6.7 (0.5)		6.5 (0.5)			5.8 (1.3)		

Comparisons across MAJCOMs and levels of training. Although there were no obvious differences in the ratings of programmed mission scenarios across MAJCOMs, the feature appeared to be more important for CTU training. Thus, FB-111A, FB-111A (EW), F-15, and E-3A flight simulator CTU SIs used the feature significantly more often than did their RTU counterparts. Moreover, A-10 CTU SIs rated programmed mission scenarios higher in training value than did A-10 RTU SIs. The ratings of manual mission control did not differ across the two levels of training. Comparisons across MAJCOMs were precluded due to a lack of data.

Variation of Task Difficulty/Fidelity Features

Automated Malfunction Insertion (Table 13)

Incidence. Automated malfunction insertion was surveyed at every ATD site. It was available for use on every device except the C-5/C-141, CH-3/HH-53, and FB-111A ATDs, and the E-3A mission simulator.

Utility and utilization. The ratings of this feature varied greatly. On two devices (viz., E-3A flight simulator, B-52 WST) it worked well, and the frequency of use was higher than it was on the remaining devices. For most of those ATDs, especially the F-4E/F-4G, F-15, and A-10, it was said that it was time-consuming to implement and unreliable, and did not always reflect mission profiles. Moreover, almost 20% of the SIs commented that they preferred to insert malfunctions manually. There was a clear parallel between the utility and utilization of automated malfunction insertion and that of programmed mission scenarios. The operational difficulties and limitations of both features restricted their use, and a substantial number of SIs preferred the benefits of manual malfunction insertion and manual mission control, respectively.

Comparisons across MAJCOMs and levels of training. Table 13 clearly suggests that the utility and utilization of automated malfunction insertion was lowest for TAC fighter ATDs. The only significant comparisons across the two levels of training were for the C-130 ATD. The feature was used more often and was rated higher in training value by RTU than by CTU SIs.

Environmental (Table 14)

Incidence. Environmental was surveyed at every non-EW ATD site. The capability was available for use on every device except the FB-111A ATD.

Utility and utilization. The mean ratings of the environmental feature were uniformly in the moderate to high range of the scales, with one exception: the E-3A mission simulator. The favorable ratings of this feature were apparently due to its easy, reliable operation and its value in training instrument flying under adverse weather conditions. Frequency of use was significantly lower on the E-3A mission simulator. Environmental simulation on this device was limited to "winds aloft."

Table 13. Automated Malfunction Insertion

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	3.7 (2.2)	3.1 (1.9)	3.4 (1.6)		3.9 (2.8)				4.5 (1.0)	5.1 (1.1)	1.4 (1.3)		3.0 (1.9)	2.6 (1.6)	1.4 (1.0)	5.4 (1.5)	
Frequency of Use-C					1.5 (0.5)				4.3 (3.1)	4.0 (2.7)	1.0 (0.0)	2.0 (1.7)	3.7 (1.7)	2.6 (1.6)	1.5 (1.2)	4.3 (1.5)	
Ease of Use-R	5.2 (1.7)	5.3 (1.0)	5.5 (1.7)		5.0 (1.9)				5.6 (0.5)	5.7 (1.3)	3.0 (2.0)		4.9 (1.3)	3.5 (1.6)	3.2 (1.6)	4.2 (1.9)	
Ease of Use-C					5.8 (0.9)				4.7 (1.2)	6.5 (0.8)	5.0 (0.0)	4.8 (2.0)	4.4 (1.2)	2.6 (1.4)	4.1 (1.5)	4.0 (2.0)	
Amount of Training Received-R	3.3 (1.7)	3.5 (1.6)			3.8 (2.1)						1.2 (0.6)		3.2 (1.6)	3.3 (1.7)		4.0 (2.1)	
Amount of Training Received-C					3.5 (1.5)						1.2 (0.6)		3.6 (1.2)	3.6 (1.5)		4.3 (0.6)	
Adequacy of Training Received-R			5.3 (2.1)						5.5 (1.5)	5.1 (2.2)					4.2 (2.0)		
Adequacy of Training Received-C									6.7 (0.6)	6.0 (1.6)		4.0 (2.4)			4.0 (2.0)		
Training Value-R	5.0 (1.6)	4.1 (2.1)	4.8 (1.6)		5.2 (1.8)				5.5 (1.5)	5.9 (0.9)	4.2 (1.3)		4.9 (1.7)	3.6 (1.7)	2.8 (1.7)	5.6 (1.5)	
Training Value-C					3.1 (1.6)				6.5 (0.6)	5.5 (2.0)	2.5 (0.7)	2.8 (2.1)	4.0 (1.8)	4.5 (1.6)	3.2 (0.9)	4.7 (1.5)	
Potential Training Value-R	5.4 (1.5)	4.7 (1.8)	4.9 (1.7)	4.7 (1.6)	5.6 (1.5)	5.4 (1.6)	4.2 (2.3)	5.5 (1.7)	4.8 (1.8)	6.2 (0.7)	4.6 (1.6)	4.3 (1.7)	4.8 (1.4)	4.4 (1.8)	4.2 (1.8)	5.8 (0.8)	3.5 (1.8)
Potential Training Value-C				4.8 (1.3)	4.8 (2.0)	5.6 (1.7)	4.7 (1.7)	5.2 (1.2)	5.5 (1.7)	6.8 (0.4)	3.4 (1.8)	4.4 (1.8)	4.5 (1.3)	4.9 (1.2)	4.0 (1.2)	5.0 (0.0)	4.0 (2.0)

Table 14. Environmental

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	5.5 (1.3)	6.3 (0.7)		5.1 (1.6)	5.4 (1.0)	4.8 (1.2)					4.1 (1.5)		4.2 (1.9)	4.5 (1.2)		6.0 (1.2)	1.9 (1.5)
Frequency of Use-C				5.3 (1.7)	6.4 (0.9)	6.2 (1.0)					3.8 (1.9)		3.1 (2.0)	3.0 (1.7)		6.3 (1.2)	2.3 (1.5)
Ease of Use-R	5.2 (1.3)	5.1 (1.3)		5.3 (0.8)	5.4 (1.2)	5.3 (0.6)					5.1 (1.2)		5.4 (1.2)	4.3 (1.0)		5.4 (1.7)	4.6 (1.5)
Ease of Use-C				5.2 (0.8)	5.9 (1.0)	5.6 (1.0)					5.3 (1.3)		4.1 (1.3)	4.8 (1.2)		6.0 (1.0)	4.5 (0.7)
Amount of Training Received-R	4.2 (1.6)	4.7 (1.1)		4.2 (1.3)	4.9 (1.4)	3.9 (1.6)					2.8 (1.3)		4.0 (1.3)	4.2 (1.1)		5.2 (1.6)	1.8 (1.3)
Amount of Training Received-C				3.7 (1.6)	4.8 (0.6)	5.4 (1.4)					3.2 (1.5)		2.9 (1.0)	3.4 (1.3)		5.0 (0.0)	2.7 (1.4)
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R	6.2 (0.9)	6.2 (1.0)		5.2 (1.3)	5.4 (1.4)	5.2 (1.5)					4.9 (1.1)		4.2 (1.2)	5.1 (1.2)		5.4 (0.9)	3.3 (1.4)
Training Value-C				5.3 (1.3)	5.9 (1.0)	5.8 (1.0)					4.1 (2.3)		3.6 (1.1)	4.0 (1.2)		6.0 (1.0)	3.3 (1.5)
Potential Training Value-R	6.3 (1.0)	6.3 (1.0)		5.5 (1.1)	5.7 (1.1)	6.2 (1.2)	5.8 (0.8)				5.0 (1.2)		4.8 (1.2)	5.6 (1.3)		5.8 (0.4)	2.8 (2.0)
Potential Training Value-C				5.9 (0.8)	6.2 (0.6)	5.9 (1.6)	5.7 (0.9)				5.1 (1.9)		3.9 (1.3)	4.6 (1.4)		4.0 (2.8)	2.4 (0.9)

Comparison across MAJCOMs and levels of training. There were no significant differences in the utility and utilization of the environmental feature across MAJCOMs. However, there were several significant differences across the two levels of training. A-10 RTU SIs used it more often and rated it higher in training value than did A-10 CTU SIs; and F-15 RTU SIs rated it easier to use and received more training in its use than did F-15 CTU SIs.

Motion (Table 15)

Incidence. Platform motion was the only form of motion cueing surveyed. It was surveyed at every non-EW ATD site. It was available for use on the T-50, T-51, C-5/C-141, C-130, CH-3/HH-53, FB-111A, and F-15 ATDs, and the E-3A flight simulator.

Utility and utilization. Except for the F-15 ATD, the utility and utilization ratings of operational platform motion cueing systems were uniformly in the high range of the rating scales. Over 60% of the F-15 SIs commented that the motion simulation was unrealistic and would not yield positive transfer of training to aircraft itself.

Comparisons across MAJCOMs and levels of training. In general, the utility (actual and potential) and utilization ratings of ATC, MAC, and SAC motion systems were clearly higher than those of TAC. A more accurate statement would be that non-fighter aircraft ATD platform motion systems were evaluated more favorably than were fighter aircraft ATD platform motion systems, since TAC's E-3A flight simulator motion system received extremely high ratings.

There were several significant differences in the ratings across the two levels of training. The F-15 RTU SIs rated motion higher in training value and potential training value than did the F-15 CTU SIs, whereas the C-5/C-141 and A-10 CTU SIs rated motion higher in training value and potential training value, respectively, than did the RTU SIs.

Partial Freeze (Table 16)

Incidence. Partial freeze was surveyed at every ATD site. It was available for use on every device except the T-5 and T-4 ATDs, and the E-3A mission simulator.

Utility and utilization. As with total system freeze, the ratings of partial freeze indicated that it tended to be implemented very easily and with moderate regularity. Although it is properly considered a variation of the task difficulty feature, partial freeze was used in a manner similar to crash/kill override (see above); that is, to manage training. In fact, over 80% of SIs occasionally used partial freeze as a substitute for total system freeze in order to temporarily suspend the training session and instruct the student. Partial freeze appeared to offer two advantages over total system freeze for this purpose. First, on certain devices (e.g., C-5/C-141, FB-111A) it was simply easier to reinitialize the ATD following a partial rather than total freeze. Second, by freezing only particular flight parameters, SIs were able to instruct while still

Table 15. Motion

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	6.6 (1.2)	6.2 (1.9)		5.1 (2.0)	6.6 (1.4)	5.3 (2.4)	5.5 (2.0)						2.5 (1.6)			6.4 (1.3)	
Frequency of Use-C				5.7 (2.1)	7.0 (0.0)	6.6 (0.9)	5.9 (1.8)						1.5 (0.7)			7.0 (0.0)	
Ease of Use-R	6.4 (0.6)	6.4 (0.7)		5.7 (1.0)	5.8 (1.1)	6.3 (0.9)	5.3 (1.8)						5.4 (1.2)			6.2 (1.3)	
Ease of Use-C				5.9 (1.3)	6.2 (1.0)	6.2 (1.0)	6.2 (1.0)						4.4 (2.0)			6.3 (0.6)	
Amount of Training Received-R	4.6 (1.6)	4.8 (2.0)		3.6 (1.5)	5.0 (1.6)	4.7 (2.2)	4.7 (0.8)						3.4 (1.7)			5.4 (1.5)	
Amount of Training Received-C				3.8 (1.6)	5.5 (1.1)	5.5 (1.9)	4.8 (1.7)						2.4 (1.3)			6.0 (1.0)	
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R	6.1 (1.0)	6.0 (1.0)		5.4 (1.3)	6.2 (1.3)	6.2 (1.4)	5.2 (1.2)						3.6 (1.6)			6.6 (0.4)	
Training Value-C				6.1 (1.1)	6.4 (0.7)	6.4 (1.1)	4.6 (2.0)						2.3 (1.2)			6.3 (1.2)	
Potential Training Value-R	6.3 (1.1)	5.9 (1.1)		5.5 (1.3)	5.9 (1.3)	5.7 (2.1)	5.7 (1.6)				3.2 (1.5)		4.2 (1.7)	3.5 (2.1)		6.8 (0.4)	1.9 (1.4)
Potential Training Value-C				6.3 (1.1)	6.6 (0.8)	6.5 (1.5)	5.2 (1.9)				3.8 (2.0)		2.4 (1.4)	5.1 (1.4)		7.0 (0.0)	1.2 (0.4)

Table 16. Partial Freeze

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	3.9 (1.7)	5.3 (1.4)		4.3 (1.8)	4.7 (1.5)	4.3 (1.7)	5.7 (1.0)	5.3 (1.2)		3.2 (1.3)	3.1 (1.5)	4.4 (0.9)	6.3 (0.8)	2.6 (1.8)	2.1 (1.8)	5.9 (1.5)	
Frequency of Use-C				3.1 (2.1)	4.1 (1.4)	4.7 (1.9)	4.8 (1.5)	4.3 (1.7)		3.2 (1.5)	3.4 (1.5)	3.9 (1.4)	3.9 (2.0)	2.6 (1.8)	2.7 (1.6)	4.8 (1.8)	
Ease of Use-R	5.5 (1.2)	6.4 (0.7)		5.9 (0.9)	5.9 (1.2)	5.5 (1.1)	5.7 (1.2)	6.3 (0.9)		5.9 (0.8)	5.4 (1.2)	5.0 (1.7)	6.9 (0.3)	5.1 (0.9)	4.3 (1.6)	5.8 (1.1)	
Ease of Use-C				5.7 (0.9)	5.8 (1.1)	5.1 (1.6)	6.2 (1.1)	6.2 (0.9)		6.5 (0.5)	5.8 (1.2)	4.9 (1.2)	6.3 (0.9)	5.1 (1.1)	5.1 (1.4)	5.6 (1.0)	
Amount of Training Received-R	3.3 (1.3)	4.5 (1.2)		3.5 (1.5)	4.4 (1.4)	3.9 (1.4)	4.2 (1.3)	4.2 (1.3)			3.0 (1.5)		4.4 (1.1)	2.8 (1.7)		4.8 (1.8)	
Amount of Training Received-C				3.2 (1.9)	4.2 (0.9)	4.9 (1.7)	4.8 (1.5)	4.1 (1.7)			3.3 (1.4)		3.2 (1.9)	3.0 (2.0)		3.3 (1.8)	
Adequacy of Training Received-R										5.3 (1.5)		5.5 (1.3)			4.8 (1.8)		
Adequacy of Training Received-C										5.6 (1.3)		5.4 (1.9)			5.2 (1.5)		
Training Value-R	4.8 (1.4)	5.3 (1.1)		5.2 (1.4)	5.2 (1.2)	5.0 (1.4)	6.5 (0.8)	6.0 (0.8)		6.0 (1.0)	4.6 (1.2)	5.6 (1.1)	6.4 (1.0)	4.6 (1.3)	4.1 (1.6)	5.6 (1.0)	
Training Value-C				5.0 (1.0)	4.8 (1.6)	5.4 (1.7)	5.7 (1.4)	6.1 (1.0)		4.5 (2.2)	4.4 (1.2)	5.1 (1.6)	5.1 (1.4)	4.4 (1.5)	4.0 (1.5)	4.9 (0.9)	
Potential Training Value-R	5.0 (1.7)	5.5 (0.8)	4.6 (2.2)	5.3 (1.3)	5.5 (1.3)	5.2 (1.0)	5.7 (1.5)	6.5 (0.7)	4.0 (2.0)	6.4 (0.5)	5.0 (1.4)	4.6 (2.1)	5.0 (1.8)	4.2 (1.8)	4.8 (1.5)	5.3 (1.3)	3.5 (2.2)
Potential Training Value-C				5.1 (1.5)	5.4 (1.6)	5.3 (1.9)	5.8 (1.3)	6.0 (1.2)	4.1 (2.5)	5.5 (2.1)	5.2 (0.9)	5.4 (1.5)	4.1 (1.6)	5.1 (1.3)	4.6 (1.4)	5.5 (1.2)	2.7 (1.5)

maintaining a relatively realistic simulated environment. In contrast, on the A-10 ATD and the B-52 WST, it was more time-consuming to implement a partial than a total system freeze, and partial freeze was used significantly less often on these devices.

Comparisons across MAJCOMs and levels of training. The utility and utilization of partial freeze did not differ across the MAJCOMs. On one device, the F-15 simulator, there were clear differences across the two levels of training: F-15 RTU SIs used partial freeze more often, found it easier to use, received more training in its use, and rated it higher in training value than did F-15 CTU SIs. However, the CTU SIs assigned higher potential training value ratings to total system freeze than did the RTU SIs. On the C-5A/C-141, partial freeze was also used more often by RTU than by CTU SIs.

Monitoring Features

Parameters and Procedures Monitoring (Tables 17 and 18)

Incidence. Parameters and procedures monitoring were surveyed on all devices except TAC's non-EW ATDs. Parameters monitoring was available for use on the T-5, C-130, CH-3/HH-53, FB-111A, T-4, B-52 WST, and A-10 (EW) ATDs. Procedures monitoring was available on the same devices, with the exception of the CH-3/HH-53 ATD.

Utility and utilization. The utility and utilization of these features was very high. Over 90% of the means were in at least the moderate range of the rating scales. The ratings tended to be highest for those devices that required SIs to monitor performance from a remote console (e.g., FB-111A, T-4), whereas the ratings were significantly lower for ATDs in which the instructor console was located in the simulation chamber with the student (e.g., C-130, CH-3/HH-53). Under these circumstances, the majority of SIs preferred to monitor student performance "over-the-shoulder" by looking at the instruments and switches directly. One exception to this trend was the A-10 ATD (EW), for which parameters and procedures monitoring received low ratings despite the remote location of these features.

Comparisons across MAJCOMs and levels of training. The utility and utilization of parameters and procedures monitoring did not differ significantly across the MAJCOMs. There were significant differences across the two levels of training on only one device, the A-10 ATD (EW). The A-10 (EW) RTU SIs used parameters and procedures monitoring more often than did the A-10 (EW) CTU SIs. In addition, the A-10 (EW) RTU SIs rated parameters monitoring higher in training value than did the A-10 (EW) CTU SIs.

Feedback Features

Record/Playback (Table 19)

Incidence. Record/playback was surveyed at every ATD site. It was available for use on all devices except the T-5, C-5/C-141, T-4, F-4E/F-4G, and F-15 ATDs, and the E-3A flight simulator.

Table 17. Parameters Monitoring

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			6.0 (1.9)		4.2 (1.7)	4.9 (2.2)	6.8 (0.4)	6.8 (0.6)	6.8 (0.8)	6.5 (0.9)					5.9 (1.7)		
Frequency of Use-C					3.2 (1.9)	6.0 (1.0)	6.7 (0.9)	6.6 (0.8)	6.7 (0.8)	5.8 (2.0)					2.2 (2.7)		
Ease of Use-R			6.2 (0.8)		5.3 (1.3)	5.8 (1.4)	4.8 (1.6)	5.0 (1.3)	5.2 (0.8)	4.4 (1.7)					4.8 (1.8)		
Ease of Use-C					3.6 (1.7)	5.5 (1.3)	4.8 (1.5)	4.1 (1.3)	6.0 (1.3)	4.3 (1.4)					6.0 (0.0)		
Amount of Training Received-R					4.3 (1.2)	4.0 (1.5)	4.3 (1.8)	5.3 (1.1)									
Amount of Training Received-C					4.1 (1.0)	4.8 (1.7)	5.4 (1.4)	5.6 (1.2)									
Adequacy of Training Received-R			6.2 (1.2)						5.8 (1.1)	5.6 (1.2)					5.5 (1.3)		
Adequacy of Training Received-C									6.1 (0.7)	5.4 (1.1)					5.2 (2.1)		
Training Value-R			5.6 (2.2)		4.7 (1.5)	5.5 (1.4)	6.5 (0.8)	6.2 (1.1)	6.0 (1.3)	4.5 (1.5)					4.7 (1.9)		
Training Value-C					4.1 (1.9)	5.5 (1.4)	6.1 (1.0)	6.5 (0.9)	6.5 (0.8)	6.2 (1.3)					2.5 (2.4)		
Potential Training Value-R	4.6 (2.2)	5.5 (1.4)	6.0 (1.5)	4.7 (1.5)	5.2 (1.1)	6.1 (1.4)	6.8 (0.4)	6.5 (0.5)	5.6 (2.2)	5.2 (2.2)		5.2 (1.2)			5.4 (1.8)		
Potential Training Value-C				4.8 (1.6)	4.7 (1.5)	5.5 (1.7)	6.4 (0.8)	6.7 (0.6)	5.5 (2.3)	6.3 (1.6)		5.0 (1.7)			4.1 (2.0)		

Table 18. Procedures Monitoring

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			6.5 (1.4)		3.0 (1.9)		6.8 (0.4)	6.8 (0.6)	6.6 (0.9)	5.0 (3.1)					4.2 (2.7)		
Frequency of Use-C					2.8 (1.4)		6.6 (1.1)	6.5 (0.9)	6.6 (0.9)	4.7 (2.9)					1.3 (0.5)		
Ease of Use-R			6.1 (0.8)		4.8 (1.3)		5.0 (1.5)	4.6 (1.7)	4.9 (1.4)	5.2 (1.6)					4.8 (1.8)		
Ease of Use-C					4.4 (1.4)		4.5 (1.6)	3.6 (1.6)	5.2 (1.1)	3.2 (1.8)					4.0 (1.6)		
Amount of Training Received-R					3.6 (1.5)		4.5 (2.0)	5.2 (1.1)									
Amount of Training Received-C					4.2 (1.0)		5.7 (1.3)	5.6 (1.2)									
Adequacy of Training Received-R			6.4 (1.1)						5.8 (1.2)	4.8 (2.1)					5.9 (1.2)		
Adequacy of Training Received-C									5.8 (1.1)	4.6 (2.0)					5.1 (0.8)		
Training Value-R			6.1 (1.8)		4.2 (1.7)		6.5 (0.8)	6.2 (1.1)	6.0 (1.5)	3.0 (1.7)					4.3 (2.2)		
Training Value-C					3.7 (1.8)		6.2 (0.9)	6.7 (0.8)	6.3 (1.2)	4.3 (2.4)					2.7 (2.0)		
Potential Training Value-R	4.3 (2.0)	5.0 (1.5)	6.5 (1.0)	4.8 (1.6)	4.9 (1.2)	4.2 (1.9)	6.8 (0.4)	6.6 (0.5)	6.0 (1.4)	4.7 (2.2)		4.8 (1.4)			4.9 (1.9)		
Potential Training Value-C				5.0 (1.6)	4.4 (1.6)	3.9 (2.2)	6.7 (0.6)	6.9 (0.3)	6.0 (2.1)	6.2 (1.6)		4.7 (1.9)			4.1 (1.7)		

Table 19. Record/Playback

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R	3.4 (1.3)	3.9 (1.3)			1.9 (1.2)	2.2 (1.2)	3.0 (1.7)	2.3 (0.8)		1.2 (0.4)				1.6 (0.7)	1.1 (0.3)		1.2 (0.6)
Frequency of Use-C					2.0 (0.7)	3.8 (1.4)	1.7 (0.9)	1.8 (0.7)		1.0 (0.0)				1.3 (0.7)	2.2 (1.0)		1.3 (0.8)
Ease of Use-R	4.9 (1.0)	5.4 (1.1)			4.1 (0.8)	4.4 (1.5)	3.6 (1.5)	3.9 (1.4)		2.8 (1.1)				3.5 (1.3)	2.3 (1.0)		2.3 (1.4)
Ease of Use-C					4.3 (1.6)	5.2 (1.0)	3.3 (1.7)	3.4 (1.1)		3.2 (1.5)				4.7 (0.6)	4.6 (1.1)		1.5 (0.7)
Amount of Training Received-R	3.5 (1.2)	4.6 (0.9)			2.8 (1.4)	2.1 (0.9)	3.5 (1.5)	2.5 (1.3)						2.3 (1.1)			1.1 (0.3)
Amount of Training Received-C					3.5 (1.2)	4.5 (1.2)	2.3 (1.3)	2.1 (1.1)						1.7 (1.4)			1.3 (0.8)
Adequacy of Training Received-R										3.5 (1.8)					3.2 (1.9)		
Adequacy of Training Received-C										3.1 (2.0)					5.0 (1.5)		
Training Value-R	4.9 (1.0)	5.5 (1.3)			3.0 (1.4)	4.1 (1.7)	4.2 (0.8)	3.8 (1.5)		3.2 (2.1)				4.1 (1.2)	1.5 (0.5)		4.6 (2.1)
Training Value-C					3.4 (1.4)	5.0 (1.8)	4.0 (1.7)	3.3 (1.4)		1.7 (1.2)				3.4 (1.3)	3.7 (1.4)		2.3 (0.6)
Potential Training Value-R	5.2 (1.3)	5.9 (1.2)	5.3 (1.4)	4.5 (1.6)	4.0 (1.6)	4.6 (1.8)	5.3 (1.0)	5.2 (1.5)	4.6 (2.0)	5.8 (0.7)	4.5 (1.9)	5.5 (1.5)	5.4 (1.1)	4.7 (1.2)	3.7 (1.7)	5.6 (1.1)	6.0 (1.6)
Potential Training Value-C				4.8 (1.7)	4.3 (1.4)	5.8 (1.6)	4.4 (1.7)	4.4 (1.7)	6.1 (1.0)	4.7 (1.8)	5.5 (0.9)	5.3 (1.6)	5.5 (1.3)	5.3 (0.9)	4.4 (1.5)	1.5 (0.7)	4.8 (1.6)

Utility and utilization. Record/playback was among the lowest rated of all instructional features. At two sites (viz., T-50, T-51), it was fairly easy to use and the ratings were in the moderate range. At each of the remaining sites, however, record/playback was rated difficult and time-consuming to implement, and operationally unreliable. Over 70% of the B-52 WST, A-10, A-10 (EW), and E-3A mission simulator SIs reported never having used the feature.

Comparisons across MAJCOMs and levels of training. The utility and utilization of record/playback did not differ across the MAJCOMs. There was only one significant comparison across the two levels of training: E-3A flight simulator RTU SIs rated record/playback higher in potential training value than did E-3A flight simulator CTU SIs.

Automated Performance Feedback (Table 20)

Incidence. Automated performance feedback was surveyed at each non-EW TAC ATD site. It was available for use only on the F-4E ATD and the E-3A mission simulator.

Utility and utilization. Automated performance feedback was apparently easy to use on the E-3A mission simulator, and its frequency of use was in the low to moderate range of the scale. In contrast, the feature was difficult and time-consuming to implement on the F-4E ATD, and its frequency of use was at the low end of the scale. In fact, the majority of F-4E SIs reported never having used the feature, preferring instead to "freeze" the mission and give verbal feedback; and over 30% were unaware of its availability.

Comparisons across MAJCOMs and levels of training. Comparisons across the MAJCOMs were precluded since data were collected only from TAC ATDs. On four of the five devices surveyed, the RTU SIs' mean rating of the potential training value was greater than that of the CTU SIs. The difference was significant only for the E-3A flight simulator, however.

Hard Copy (Table 21)

Incidence. Hard copy was surveyed at every ATD site. It was available for use on all devices except the T-50, T-51, C-5/C-141, CH-3/HH-53, T-4, and A-10 (EW) ATDs.

Utility and utilization. The frequency of use of hard copy was uniformly low, with mean ratings all in the "rarely" to "occasionally" range of the scale. The only successful implementation of this feature appeared to be on the T-5 ATD, where utility and ease of use were very high. Yet, it was used only once every two to four missions, on the average. Hard copy was one of the most problematic features surveyed. For example, on the C-130 ATD, it was said to be seldom operational and time-consuming to implement. On the B-52 WST, it was said to yield output that was difficult to interpret. And on the F-4G (EW) ATD, it was called "unreliable" by 28% of the SIs and was either never operated or presumed unavailable by 53% of the SIs.

Table 20. Automated Performance Feedback

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R											1.5 (0.8)						3.4 (2.6)
Frequency of Use-C											1.7 (0.7)						2.7 (2.6)
Ease of Use-R											2.1 (0.9)						6.3 (0.8)
Ease of Use-C											3.0 (0.0)						6.0 (1.4)
Amount of Training Received-R											1.6 (1.6)						2.4 (2.1)
Amount of Training Received-C											1.3 (0.6)						2.2 (1.8)
Adequacy of Training Received-R																	
Adequacy of Training Received-C																	
Training Value-R											3.1 (1.0)						4.1 (2.3)
Training Value-C											3.3 (2.3)						5.0 (0.0)
Potential Training Value-R											4.4 (1.7)		4.3 (1.8)	3.8 (1.7)		5.0 (1.4)	5.3 (1.8)
Potential Training Value-C											4.3 (0.6)		3.3 (1.7)	3.8 (1.7)		1.5 (0.7)	3.8 (1.9)

Table 21. Hard Copy

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			2.9 (1.7)		2.6 (1.2)		1.2 (0.4)	1.5 (0.7)		2.2 (0.7)	1.8 (0.8)	2.3 (1.8)	1.2 (0.5)	2.6 (1.6)		1.0 (0.0)	2.6 (1.2)
Frequency of Use-C					2.1 (0.8)		1.3 (0.6)	1.3 (0.7)		2.0 (1.5)	1.8 (1.3)	2.0 (1.5)	2.1 (1.5)	1.6 (1.2)		1.0 (0.0)	2.8 (1.8)
Ease of Use-R			6.2 (1.0)		4.7 (1.4)		3.0 (2.0)	2.0 (0.8)		4.4 (1.8)	3.3 (1.6)	4.2 (1.6)	4.8 (2.1)	4.6 (1.5)		2.0 (1.4)	5.6 (1.0)
Ease of Use-C					4.8 (1.6)		2.4 (1.9)	3.0 (1.8)		4.5 (0.8)	3.5 (1.8)	4.1 (2.1)	4.1 (1.4)	5.2 (1.0)		- -	5.6 (0.9)
Amount of Training Received-R					3.4 (1.7)		1.2 (0.4)	1.4 (0.7)			2.0 (1.6)		1.3 (0.7)	3.3 (1.3)		1.0 (0.0)	3.3 (1.5)
Amount of Training Received-C					3.8 (1.0)		1.4 (0.7)	1.4 (0.7)			1.8 (1.5)		2.5 (1.1)	2.8 (1.8)		1.0 (0.0)	4.0 (0.6)
Adequacy of Training Received-R			6.0 (1.2)							4.8 (1.9)		4.4 (1.6)					
Adequacy of Training Received-C										5.2 (1.3)		4.6 (2.1)					
Training Value-R			6.1 (1.7)		3.1 (1.3)		1.7 (1.2)	2.2 (0.4)		3.1 (1.5)	4.0 (1.5)	3.6 (1.5)	3.6 (1.6)	4.0 (1.6)		1.0 (0.0)	3.7 (1.5)
Training Value-C					3.2 (1.6)		2.7 (1.3)	3.1 (1.4)		2.5 (1.5)	4.7 (0.8)	3.7 (1.7)	3.7 (1.5)	3.0 (1.7)		- -	3.2 (0.8)
Potential Training Value-R	4.5 (2.0)	4.5 (1.3)	6.6 (1.0)	3.7 (1.6)	4.1 (1.5)	3.9 (1.8)	3.5 (2.1)	4.5 (1.9)	3.2 (1.9)	5.2 (1.6)	4.7 (1.2)	4.6 (1.1)	4.5 (1.6)	4.4 (1.5)	4.1 (1.8)	4.0 (1.9)	4.6 (1.6)
Potential Training Value-C				3.8 (1.7)	3.9 (1.8)	4.1 (2.3)	4.1 (1.6)	4.1 (1.6)	4.1 (2.2)	4.3 (2.3)	4.4 (1.5)	5.2 (1.3)	4.2 (1.9)	3.5 (1.6)	4.3 (1.6)	3.5 (2.1)	2.8 (1.1)

Comparison across MAJCOMs and levels of training. The utility and utilization of the hard copy feature did not differ across the MAJCOMs. There was only one significant comparison across the two levels of training: F-15 CTU SIs received more training in the use of hard copy than did F-15 RTU SIs.

Performance Scoring (Table 22)

Incidence. Performance scoring was surveyed at every EW ATD site. The feature was available for use on the T-5, B-52 WST, and A-10 devices.

Utility and utilization. Despite reports of "unreliability" on the B-52 and A-10 ATDs, performance scoring generally received higher utility and utilization ratings than the other feedback features (e.g., record/playback and hard copy). On the T-5 ATD, performance scoring was used between two and four times each mission, on the average. A-10 RTU SIs reported using the feature even more frequently, between five and seven times each mission, on the average. Performance scoring was rated as "moderately" (B-52 WST) to "extremely" (T-5) useful.

Comparisons across MAJCOMs and levels of training. Comparisons across the MAJCOMs were precluded since data on this feature were collected from relatively few ATDs. There was only one significant comparison across the two levels of training: A-10 RTU SIs used performance scoring more frequently than did A-10 CTU SIs (an average of five to seven times a mission versus once every two to four missions, respectively).

Amount and Adequacy of Training Received by Simulator Instructors

SIs generally received a greater amount of training in the use of those features that were also rated higher in utility and utilization. This was indicated by the significant positive intercorrelations between the ratings of each AIF on the five survey questions. There were clear differences in the amount of training received across the MAJCOMs. TAC mean ratings (non-electronic warfare) were lower than those of the other MAJCOMs for over 81% of the features surveyed. Moreover, TAC SIs tended to characterize their training as "informal." In contrast, ATC, MAC, and SAC SIs (non-EW) tended to characterize their training as "formal."

Observations concerning the adequacy of training received by the SIs must be considered tentative, since the relevant data were collected only during the EW phase of the project. Nevertheless, the high ratings suggest that the SIs from ATC, MAC, SAC, and TAC would each characterize their training as adequate.

Some additional data of interest were collected during the EW phase of the project. These related to the relative impact of "initial" and "refresher" training on AIF utility and utilization. The amount of formal initial training appeared to relate positively to the magnitude of the ratings. For example, T-4 and T-5 SIs received a greater amount of formal training than did other SIs (classroom instruction accounted for 54% and 28% of initial training, respectively), and the T-4 and T-5 ATDs were probably the most favorably evaluated devices. The impact of refresher

Table 22. Performance Scoring

Mean Ratings (and Standard Deviations) of the Frequency of Use, Ease of Use, Amount of Training Received, Adequacy of Training Received, Training Value, and Potential Training Value by RTU (R) and CTU (C) Simulator Instructors

	ATC			MAC			SAC				TAC						
	T-50	T-51	T-5 (EW)	C-5/ C-141	C-130	CH-3/ HH-53	FB-111A	FB-111A (EW)	T-4 (EW)	B-52 WST (EW)	F-4E/ F-4G	F-4G (EW)	F-15	A-10	A-10 (EW)	E-3A FS	E-3A MS
Frequency of Use-R			5.3 (2.1)							2.9 (1.9)					6.1 (1.7)		
Frequency of Use-C										4.2 (2.6)					3.3 (2.2)		
Ease of Use-R			6.4 (1.0)							5.1 (1.6)					4.6 (1.7)		
Ease of Use-C										3.8 (1.9)					4.3 (1.6)		
Amount of Training Received-R																	
Amount of Training Received-C																	
Adequacy of Training Received-R			6.6 (0.7)							5.0 (1.8)					5.6 (1.2)		
Adequacy of Training Received-C										5.2 (2.0)					4.6 (1.7)		
Training Value-R			6.2 (1.5)							3.8 (1.8)					3.7 (2.0)		
Training Value-C										3.0 (2.3)					3.8 (1.8)		
Potential Training Value-R			6.3 (1.2)						4.2 (1.9)	5.8 (1.3)		5.0 (2.0)			5.9 (0.9)		
Potential Training Value-C									4.4 (2.1)	5.3 (2.3)		5.2 (1.8)			4.6 (2.0)		

training was less clear. For example, T-4 and A-10 (EW) SIs received a greater amount of refresher training than did other SIs (42% of T-4 SIs and 45% of A-10 SIs received refresher training at least once within the immediately preceding year), but the A-10 ratings tended to be much lower than those of the T-4.

IV. DISCUSSION

General Trends

Interrelations Among the Ratings

The results indicated that an AIF was used to the extent that: SIs were trained in its use, it was easy to use, and it had apparent training value. However, training value was clearly the most significant predictor at almost every ATD site surveyed. What can be concluded from these facts? Unfortunately, correlational findings do not logically imply causality; they merely reflect the presence of a relationship among variables. In this case, however, it seems reasonable to assume that particular AIFs were used more frequently because they were more useful. Indeed, assuming that the training value of an AIF did not affect its use is clearly implausible.

How can the fact be explained that the remaining variables (viz., ease of use, amount/adequacy of training received) did not account for much of the variability in frequency of use? This fact suggests that SIs would not avoid using a particular feature, even if it were complicated to use, as long as they believed that it would help accomplish mission objectives.

Overview of the Rating Data

There were two general trends revealed in the overview of the rating data (Figures 1 through 6). The first had to do with differences in utility and utilization among the various types of features. Thus, training management, variation of task difficulty/fidelity, and monitoring features tended to receive the highest ratings, whereas briefing and feedback features tended to receive the lowest ratings. The fact that this trend was observed at every ATD site suggests that, regardless of differences in particular mission requirements, SIs adopted a common strategy for the use of instructional features. Apparently the strategy was one in which the use of AIFs was concentrated during the actual mission performance (e.g., for training management). Although certain AIFs could be used outside the mission context (e.g., for briefing), they were used less often. There were two notable exceptions to this trend. Automated adaptive training, a training management feature, received extremely low utility and utilization ratings, whereas performance scoring, a feedback feature, generally received high ratings. These two AIFs will be discussed in greater detail below.

The second general trend revealed in the overview of the data had to do with differences in the ratings of certain features across the two

levels of training. The differences between the RTU and CTU SIs' use of AIFs appeared to reflect a critical distinction between the two types of missions. RTU missions tended to stress the acquisition of discrete skills and procedures, whereas CTU missions tended to maintain the broader mission context. Thus, RTU SIs were more likely to interrupt or otherwise alter the mission in order to afford students sufficient opportunity for practice and feedback; they more frequently invoked features such as freeze, reset, environmental, and parameters and procedures monitoring in order to accomplish this objective. In contrast, CTU SIs spent less time interrupting the mission in order to achieve a more continuous and realistic scenario. Programmed scenarios were ideally suited for this purpose, and they were more frequently invoked by CTU SIs.

It is important to point out, however, that the differences described above were not evidenced at each ATD site. In fact, there were no significant differences between RTU and CTU ratings on over 40% of the devices, excluding ATC (viz., CH-3/HH-53, T-4, B-52 WST, F-4E/F-4G, F-4G EW, E-3A mission simulator). Even on devices where differences were observed (e.g., F-15 ATD), the majority of features were used similarly by RTU and CTU SIs. Thus, SIs were more similar in their use of AIFs than they were different. Both groups used the same features to one degree or another, and each ATD could readily accommodate either type of training.

Utility and Utilization Ratings

Briefing Features

The briefing features, recorded briefing and demonstration, tended to be among the least valued and least used features of those surveyed. The SIs' comments suggested that there were two major reasons for the low ratings. First, SIs generally preferred to brief students themselves. This was probably a more reasonable strategy since individual students' needs might differ, and a "generic" briefing might not be appropriate for all students. Second, the low ratings undoubtedly reflected operational difficulties and limitations associated, particularly, with demonstration. The most commonly reported problems were "time-consuming implementation" and "unreliability." This would seem unfortunate, since, according to social learning theory, "a large amount of human learning is done vicariously, through observing another person making the skilled responses... and then trying to imitate the response of the model" (Hilgard & Bower, 1975, pp. 599-605). Nevertheless, empirical evidence from the aircrew flight training literature suggests that the use of demonstration is no more effective for training than is simple performance feedback (Hughes et al., 1979).

The potential training value mean ratings were unremarkable. They were similar across the ATDs and were all in the moderate range of the scale. None of the devices surveyed had an instructor tutorial capability, and it is therefore difficult to discuss the utility and utilization of this feature. However, the few SIs that commented on instructor tutorial apparently preferred "hands-on" experience and/or "face-to-face" tutorials for learning the operation of the instructor console.

Training Management Features

Freeze and reset were among the highest rated of all features surveyed. This was true for virtually every device that was surveyed. The ability to temporarily suspend a mission in order to instruct a student, and then allow the mission to continue, appeared to be essential for effective training management, especially for RTU training, in which the acquisition of discrete skills and procedures was stressed. Yet, the empirical evidence for the training effectiveness of these features is less clear. Bailey, Hughes, and Jones (1980) successfully used freeze and reset in their application of the behavioral "backward chaining" paradigm to air-to-surface weapon delivery training. On the other hand, Hughes et al. (1982) were unable to significantly improve carrier glideslope tracking performance by using freeze as opposed to a more conventional "no freeze" training approach. Their approach was to freeze the simulator whenever a glideslope error was detected. The simulator was then returned to the previous position, with appropriately configured angle-of-attack and airspeed, and the student was allowed to try again.

Crash-kill override was typically "left on" for most training applications in order to avoid reinitializing the simulator following a "crash" or "kill" and, thus, preserve instruction time. "Crashes" were allowed to occur more frequently on ATC trainers (viz., T-50, T-51). Several ATC SIs commented that entry-level pilots must be taught to be sensitive to dangerous conditions. Experiencing a simulated crash is apparently one way to accomplish this objective.

Automated adaptive training received the lowest utility and utilization ratings of the training management features; however, it is difficult to draw any firm conclusions since the feature was operational on only one ATD, the F-4E/F-4G. Notwithstanding the low ratings, there is considerable evidence that automated adaptive training has training utility (Brown, Waag, & Eddowes, 1975; Charles, Johnson, & Swink, 1971, 1973; Charles, Willard, & Healey, 1975; Feuge, Charles, & Miller, 1973). According to Brown et al. (1975), the major difficulties with automated adaptive training are limited training scenarios, the high cost of software implementation, the lack of formal instructor training in the use of the feature, and the lack of training directives to implement such training.

Programmed mission scenarios were used to "streamline" a training session by freeing a simulator instructor to perform other important duties, such as monitoring student performance and giving feedback. Programmed scenarios were especially useful for CTU missions, which tended to be interrupted less often than were RTU missions. However, as discussed earlier, there were certain operational limitations associated with the use of programmed mission scenarios. Thus, the programming of scenarios was tedious and difficult, and there were few available scenarios at most training sites. Moreover, those that were available were frequently characterized as "unreliable," "limited," or "outdated." Although manual mission control afforded the SI a greater degree of instructional flexibility, it required considerable time and effort.

Variation of Task Difficulty/Fidelity Features

Most emergencies can be safely dealt with only under simulated conditions, and the frequent insertion of simulated malfunctions was characteristic of every training mission that was observed. However, the same problems that limited the use of programmed mission scenarios also limited the use of automated malfunction insertion at the majority of ATD sites. It was said that it was time-consuming to program and implement and unreliable, and did not always reflect mission profiles. Roughly one in five SIs preferred to insert malfunctions manually, despite the greater effort that was required.

Of the two "fidelity" features that were surveyed, environmental and motion, environmental appeared to be the least problematic. The utility and utilization ratings of the environmental feature were uniformly favorable, except for the E-3A mission simulator, which had a very limited environmental capability. Platform motion cueing was more frequently used and was considered a more useful training feature than was environmental; however, at every ATD site, the motion system was difficult to maintain and was sometimes inoperable.

As described in the Results section, motion received higher utility ratings from non-fighter SIs (e.g., C-130, E-3A flight simulator) than from fighter SIs (e.g., F-15). This difference was probably due to the fact that platform motion cueing systems are not capable of high-fidelity simulation of fighter aircraft movement. Empirical evidence suggests that platform motion cueing is more useful in non-fighter applications. Thus, Ricard, Parrish, Ashworth, and Wells (1981) found that platform motion cueing was effective for helicopter hover simulation training, whereas Martin and Waag (1978a, 1978b) found that it was ineffective for basic contact maneuvers and aerobatics. The general utility of motion was also questioned by Cyrus (1978), who concluded in his literature review that, for most tasks, the elimination of platform motion cues does not reduce training effectiveness.

The final feature in this group, partial freeze, was most often used as a substitute for total system freeze; and both features shared high utility and utilization ratings for similar reasons. However, partial freeze also permitted SIs to vary the student's task load by selectively freezing particular aircraft parameters. Partial freeze may therefore offer certain advantages over total system freeze, since it can be used both to manage training and to vary task difficulty.

Monitoring Features

Parameters monitoring and procedures monitoring permitted an SI to monitor student performance during a simulated mission by means of alphanumeric and/or graphic CRT displays of performance data. Not surprisingly, parameters and procedures monitoring were among the highest rated features.

The monitoring displays were usually viewed at a remote instructor's console. Alternate but less-sophisticated capabilities for monitoring student performance from a remote console included repeaters (replicas of flight instruments) and annunciators (indicators that are directly linked to aircraft controls and switches). On some devices (e.g., C-130 ATD, CH-3/HH-53 ATD), the instructor console was located within the simulator cockpit. In these situations, SIs could monitor performance by means of displays or by directly viewing the student "over-the-shoulder." Interestingly, repeaters, annunciators, or "over-the-shoulder" were often the preferred means of monitoring student performance. This suggests that SIs, most of whom are experienced aircrew members themselves, find it easier to monitor parameters and procedures in ways similar to those used during actual flying. This also suggests that the utility of remote parameters and procedures monitoring displays will depend on the format in which performance information is presented; e.g., digital displays of round dial instrument readings will be unacceptable to most SIs.

Feedback Features

Record/playback and hard copy were available for use on the majority of ATDs surveyed. The ratings of these features were uniformly low, with the exception of the ATC devices (e.g., record/playback on the T-50 and T-51 ATDs, and hard copy on the T-5 ATD). The utility of the record/playback and hard copy features was limited by operational problems that discouraged their use. Both features were difficult and time-consuming to implement and were operationally unreliable. Had these features functioned reliably and efficiently, they might have been used more often. Indeed, the giving of feedback was a normal instructional procedure at every ATD site, although such feedback was more often given verbally than by means of AIFs.

The amount of data collected on automated performance feedback and performance scoring was too small to support any firm conclusions. Automated performance feedback was operational on only two devices, the F-4E ATD and the E-3A mission simulator. The majority of F-4E SIs had never used the feature because it was difficult and time-consuming to implement. The E-3A mission simulator SIs used it infrequently. The potential training value ratings suggested that automated performance feedback could be useful, especially for RTU training. One advantage of automated performance feedback is that it is relatively unobtrusive, since it merely presents an "error cue" while allowing the mission to continue. By using automated performance feedback during RTU missions, where errors are more frequent, the instruction time that is normally used for verbal feedback could be saved.

In contrast to the other feedback features, performance scoring received generally favorable utility and utilization ratings. There are two possible reasons for the high ratings. First, the feature was easy to use and was reliable. Second, as with automated performance feedback, performance scoring saved instruction time by "summarizing" performance automatically.

The only experimental evidence of the utility of the feedback features concerns record/playback. Hughes, Hannon, and Jones (1979) found that the periodic use of a replay of student performance was more effective in reducing errors during subsequent performance than was the use of an instructor-recorded "demonstration." However, record/playback was no more effective than simple practice.

Training Received by Simulator Instructors

As described in a previous section of this report, there were considerable differences across ATD sites in the amount and type of training received by the SIs. TAC SIs apparently received less training than did ATC, MAC, or SAC SIs; and TAC training was more often characterized as "informal." Yet the electronic warfare results indicated that TAC, ATC, MAC, and SAC SIs each rated their training as adequate, despite the stated differences in amount and type. This suggests that there may not be a "best" way to train SIs, but an important question needs to be answered before any firm conclusions can be drawn: What, precisely, are the appropriate criteria for "adequate" training? These will need to be empirically determined.

V. RECOMMENDATIONS

Improve the Training of SIs

It is clear from this survey that the existing AIF capabilities of Air Force ATDs have not been fully explored. This is partly due to operational problems that have precluded the use of certain features, but it is also likely due to insufficient training of SIs.

The extensive AIF capabilities of modern ATDs provide an inherently flexible and dynamic training environment. Many different AIFs can be implemented singly or in combination at various points during a simulated mission. What should SIs be taught about implementing AIFs? Whatever form the training of SIs takes (the results of the survey suggest that both formal and informal training may be effective), SIs must be taught not only how to use the available AIFs but also how to use them effectively (i.e., in ways that will maximize the acquisition and retention of aircrew skills).

Specify Guidelines for Using AIFs Effectively

Guidelines for using AIFs effectively need to be expressed in operational terms. It is not sufficient for SIs to know how to use a feature; they must also know when to use it. That is, SIs must know when to use a feature during a mission in order to maximize student performance.

Guidelines for effective AIF use still need to be specified, however. Such guidelines cannot be derived from surveys. They require the conducting of experiments that compare the effects of implementing or not implementing a particular AIF on various performance criteria (e.g., deviation from glideslope or accuracy of weapon delivery). The few experiments of this type that have been conducted were mentioned in previous sections of this report. Many more are needed.

Improve the Operability of Advanced Instructional Features (AIFs)

If the instructional capability of ATDs is to be fully realized, AIFs will need to be made more reliable and user-friendly. This survey revealed that there were operational problems with one or more features at every ATD site. A feature cannot be used effectively if it is difficult, time-consuming, or simply impossible to implement. ATD design requirements must ensure that the full range of instructional capabilities can be utilized and maintained.

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APPENDIX A: SIMULATOR INSTRUCTORS SURVEYED IN PHASES I, II, AND III

Table A-1. Simulator Instructors (SIs) Surveyed in Phase I

Command	ATD	ATD-Sites	Level of training	Type of SI	N	Instructor hours
TAC	F-4E F-4G	George AFB, CA	Replacement	IP	16	242.2 (290.6)
		George AFB, CA	Continuation	IP	10	171.5 (192.0)
	F-15	Luke AFB, AZ	Replacement	IP	20	171.2 (108.9)
		Eglin AFB, FL Langley AFB, VA	Continuation	IP	19	115.3 (107.7)
	A-10	Davis-Monthan AFB, AZ	Replacement	IP	26	21.9 (39.9)
		Myrtle Beach AFB, SC	Continuation	IP	12	21.2 (18.3)
	E-3A Flight Simulator	Tinker AFB, OK	Replacement	IP	5	362.4 (476.4)
		Tinker AFB, OK	Continuation	IP	3	332.7 (103.0)
	E-3A Mission Simulator	Tinker AFB, OK	Replacement	WDI	17	529.4 (491.8)
		Tinker AFB, OK	Continuation	WDI	6	217.7 (293.1)
					134	

Table A-2. Simulator Instructors (SIs) Surveyed in Phase II

Command	ATD	ATD-Sites	Level of training	Type of SI	N	Instructor hours
ATC	T-50	Williams AFB, AZ	Basic	IP	29	173.6 (169.5)
	T-51	Williams AFB, AZ	Basic	IP	21	129.4 (96.8)
MAC	C-5A	Altus AFB, OK	Formal	IP,IFE	29	511.1 (452.1)
		Dover AFB, DE	Operational	IP,IFE	17	454.1 (386.8)
	C-141	Altus AFB, OK	Formal	IP,IFE	40	582.5 (531.4)
		McGuire AFB, OK	Operational	IP,IFE	13	1174.6 (1504.1)
	C-130	Little Rock AFB, AR	Formal	IP,IFE	21	126.8 (80.4)
		Little Rock AFB, AR	Operational	IP,IFE	13	419.8 (189.9)
	CH-3	Kirtland AFB, NM	Formal	IP,IFE	6	169.2 (94.4)
		Kirtland AFB, NM	Operational	IP,IFE	5	263.4 (132.7)
	HH-53	Kirtland AFB, NM	Formal	IP,IFE	5	139.2 (149.8)
		Kirtland AFB, NM	Operational	IP,IFE	12	482.5 (452.1)
SAC	FB-111A	Plattsburgh AFB, NY	Transition	IP,IRN	17	797.1 (693.3)
		Plattsburgh AFB, NY Pease AFB, NH	Operational	IP,IRN	45	353.0 (818.4)
					273	

Table A-3. Simulator Instructors (SIs) Surveyed in Phase III

Command	ATD	ATD-Sites	Level of training	Type of SI	N	Instructor hours
ATC	T-5	Mather AFB, CA	Basic	IEW	19	287.4 (276.0)
SAC	T-4 (B-52)	Castle AFB, CA	Transition	IEW	20	731.2 (754.6)
		Mather AFB, CA	Operational	IEW	8	188.9 (224.6)
	WST (B-52)	Castle AFB, CA	Transition	IEW,IAG	9	674.9 (747.8)
		Wurtsmith AFB, MI	Operational	IEW,IAG	6	396.2 (231.9)
	*FB-111A	Plattsburgh AFB, NY	Transition	IRN	11	677.3 (426.2)
		Plattsburgh AFB, NY	Operational	IRN	9	175.6 (213.8)
		Pease AFB, NH	Operational	IRN	12	210.2 (182.7)
TAC	F-4G	George AFB, CA	Replacement	IEW	13	128.4 (116.1)
		George AFB, CA	Continuation	IEW,IP	19	73.1 (56.4)
	A-10	Davis-Monthan AFB, AZ	Replacement	IP	16	98.8 (85.8)
		England AFB, LA	Continuation	IP	17	52.6 (37.4)
					159	

* Data from these sites were collected during Phase II.

APPENDIX B: SURVEYS FOR PHASES I, II, AND III

PHASE I QUESTIONNAIRE

ADVANCED INSTRUCTIONAL FEATURES - IP SURVEY

Name_____Rank_____Squadron_____Date_____

FLYING EXPERIENCE:

Aircraft	Total Hours	IP Hours

SIMULATOR EXPERIENCE:

Simulator	Total Hours	IP Hours

BRIEFLY DESCRIBE A "TYPICAL" TRAINING SESSION ON THIS SIMULATOR:

Please familiarize yourself with these instructional features and their definitions:

Instructor Pilot Tutorial - provides the IP with self-paced programmed instruction in the capabilities and use of the flight simulator.

Reset - permits instructor to "return" the simulated aircraft to a stored set of conditions and parameters.

Total System Freeze - permits instructor to interrupt and suspend simulated flight by freezing all system parameters.

Recorded Briefing - permits instructor to provide student with information about a structured training session through audio/visual media presentation.

Demonstration - permits instructor to demonstrate aircraft maneuver(s) by prerecording and subsequently playing back a standardized segment of simulated flight.

Record/Playback - permits instructor to record and subsequently playback all events that occurred during a segment of simulated flight.

Environmental - permits instructor to vary environmental conditions such as wind direction and velocity, turbulence, temperature, visibility, etc.

Automated Malfunction Insertion - permits instructor to pre-program a sequence of aircraft component malfunctions and/or emergency conditions.

Flight System Freeze - permits instructor to simultaneously freeze flight control and propulsion systems, latitude, longitude, altitude, and heading.

Position Freeze - permits instructor to simultaneously freeze latitude and longitude.

Parameter Freeze - permits instructor to freeze any one or combination of flight parameters.

Crash and/or Kill Override - permits instructor to allow simulated flight to continue without interruption following a "crash" or "kill."

Motion - permits instructor to vary platform motion system cues such as roll, pitch, lateral, vertical, etc.

Automated Performance Feedback - provides student with visual and/or auditory signals (including verbal messages) that identify performance deficiencies.

Hard Copy - provides a record of alphanumeric and/or graphic performance data from the automated performance measurement system for debriefing purposes.

Automated Adaptive Training - computer-controlled variations in task difficulty, complexity, and sequence based on pilot's performance.

Programmed Mission Scenarios - computer-controlled standardized training sessions based on pre-programmed event sequences.

PHASE I QUESTIONNAIRE (Continued)

1. How often have you used each instructional feature? (Check the appropriate space.)

Feature — unavailable/never/rarely/occasionally/ moderately often /frequently/ very frequently/most often

Instructor Pilot Tutorial
Comments:

Reset
Comments:

Total System Freeze
Comments:

Recorded Briefing
Comments:

Demonstration
Comments:

Record/Playback
Comments:

Environmental
Comments:

Automated Malfunction Insertion
Comments:

Flight System Freeze
Comments:

Position Freeze
Comments:

Parameter Freeze
Comments:

Crash and/or Kill Override
Comments:

Motion
Comments:

Automated Performance Feedback
Comments:

Hard Copy
Comments:

Automated Adaptive Training
Comments:

Programmed Mission Scenarios
Comments:

PHASE I QUESTIONNAIRE (Continued)

2. How easy is it to use each instructional feature? (Check the appropriate space.)

Feature	never used or/ unavailable	/ most difficult	/ very difficult	/ difficult	/ moderate	/ easy	/ very easy	/ easiest /
		0	1	2	3	4	5	6	7
Instructor Pilot Tutorial									
Comments:									
Reset									
Comments:									
Freeze									
Comments:									
Recorded Briefing									
Comments:									
Demonstration									
Comments:									
Record/Playback									
Comments:									
Environmental									
Comments:									
Automated Malfunction Insertion									
Comments:									
Flight System Freeze									
Comments:									
Position Freeze									
Comments:									
Parameter Freeze									
Comments:									
Crash and/or Kill Override									
Comments:									
Motion									
Comments:									
Automated Performance Feedback									
Comments:									
Hard Copy									
Comments:									
Automated Adaptive Training									
Comments:									
Programmed Mission Scenarios									
Comments:									

PHASE I QUESTIONNAIRE (Continued)

3. How much training did you receive in the use of each instructional feature? (Check the appropriate space. Please comment as to whether the training was formal or informal.)

Feature	unavailable/ none /minimal/ some /moderate/considerable/great/greatest/ 0 1 2 3 4 5 6 7
Instructor Pilot Tutorial	
Comments:	
Reset	
Comments:	
Total System Freeze	
Comments:	
Recorded Briefing	
Comments:	
Demonstration	
Comments:	
Record/Playback	
Comments:	
Environmental	
Comments:	
Automated Malfunction Insertion	
Comments:	
Flight System Freeze	
Comments:	
Position Freeze	
Comments:	
Parameter Freeze	
Comments:	
Crash and/or Kill Override	
Comments:	
Motion	
Comments:	
Automated Performance Feedback	
Comments:	
Hard Copy	
Comments:	
Automated Adaptive Training	
Comments:	
Programmed Mission Scenarios	
Comments:	

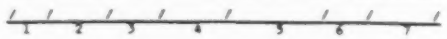
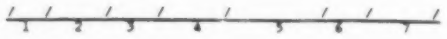
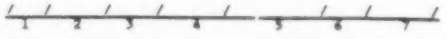
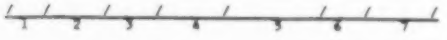
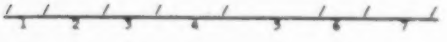
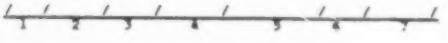
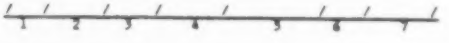
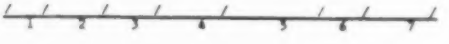
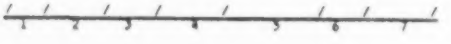
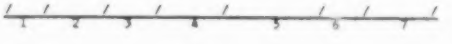
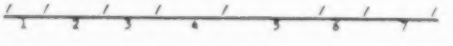
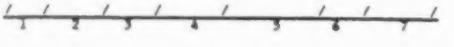
PHASE I QUESTIONNAIRE (Continued)

4. Rate the training value of each instructional feature. (Check the appropriate space.)

Feature	never used or/ unavailable/ none /minimal/ some /moderate/considerable/great/greatest/ 0 1 2 3 4 5 6 7
Instructor Pilot Tutorial	
Comments:	
Reset	
Comments:	
Total System Freeze	
Comments:	
Recorded Briefing	
Comments:	
Demonstration	
Comments:	
Record/Playback	
Comments:	
Environmental	
Comments:	
Automated Malfunction Insertion	
Comments:	
Flight System Freeze	
Comments:	
Position Freeze	
Comments:	
Parameter Freeze	
Comments:	
Crash and/or Kill Override	
Comments:	
Motion	
Comments:	
Automated Performance Feedback	
Comments:	
Hard Copy	
Comments:	
Automated Adaptive Trai...	
Comments:	
Programmed Mission Scenarios	
Comments:	

PHASE I QUESTIONNAIRE (Concluded)

5. Rate the potential training value of each instructional feature, including those you are not familiar with. Assume that you have had no experience using any of the features and that all of them are equally easy to use. Therefore, base your ratings on the feature definitions alone. (Check the appropriate space.)

Feature	none / minim... / moderate/considerable/great/greatest/
Instructor Pilot Tutorial	
Comments:	
Reset	
Comments:	
Total System Freeze	
Comments:	
Recorded Briefing	
Comments:	
Demonstration	
Comments:	
Record/Playback	
Comments:	
Environmental	
Comments:	
Automated Malfunction Insertion	
Comments:	
Flight System Freeze	
Comments:	
Position Freeze	
Comments:	
Parameter Freeze	
Comments:	
Crash and/or Kill Override	
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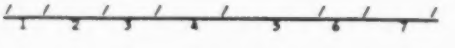
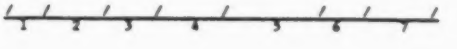
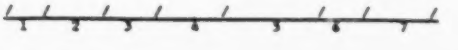
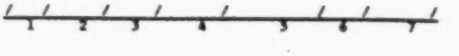
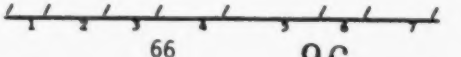
Motion	
Comments:	
Automated Performance Feedback	
Comments:	
Hard Copy	
Comments:	
Automated Adaptive Training	
Comments:	
Programmed Mission Scenarios	
Comments:	

PHASE II QUESTIONNAIRE

ADVANCED INSTRUCTIONAL FEATURES - IP SURVEY

Name_____Rank_____Squadron_____Date_____

FLYING EXPERIENCE:

Aircraft	Total Hours	IP Hours

SIMULATOR EXPERIENCE:

Simulator	Total Hours	IP Hours

BRIEFLY DESCRIBE A "TYPICAL" TRAINING SESSION ON THIS SIMULATOR:

GENERAL COMMENTS AND/OR RECOMMENDATIONS:

PHASE II Questionnaire (Continued)

Please familiarize yourself with these instructional features and their definitions: For each feature, insert 1 (available) or 0 (unavailable):

(1/0)

____ Instructor Pilot Tutorial - provides the IP with self-paced programmed instruction in the capabilities and use of the flight simulator.

____ Reset - permits instructor to "return" the simulated aircraft to a stored set of conditions and parameters.

____ Total System Freeze - permits instructor to interrupt and suspend simulated flight by freezing all system parameters.

____ Recorded Briefing - permits instructor to provide student with information about a structured training session through audio/visual media presentation.

____ Demonstration - permits instructor to demonstrate aircraft maneuver(s) by prerecording and subsequently playing back a standardized segment of simulated flight.

____ Record/Playback - permits instructor to record and subsequently playback all events that occurred during a segment of simulated flight.

____ Environmental - permits instructor to vary environmental conditions such as wind direction and velocity, turbulence, temperature, visibility, etc.

____ Automated Malfunction Insertion - permits instructor to pre-program a sequence of aircraft component malfunctions and/or emergency conditions.

____ Partial Freeze - permits instructor to freeze various flight parameters or parameter combinations such as altitude, heading, position, attitude, flight system, etc.

____ Crash and/or Kill Override - permits instructor to allow simulated flight to continue without interruption following a "crash" or "kill."

____ Motion - permits instructor to vary platform motion system cues such as roll, pitch, lateral, vertical, etc.

____ Hard Copy - provides a record of alphanumeric and/or graphic performance data from the automated performance measurement system for debriefing purposes.

____ Automated Adaptive Training - computer-controlled variations in task difficulty, complexity, and sequence based on pilot's performance.

____ Programmed Mission Scenarios - computer-controlled standardized training sessions based on pre-programmed event sequences.

____ Procedures Monitoring - permits instructor to monitor discrete actions performed by the student in accordance with a procedurally defined checklist.

____ Parameters Monitoring - permits instructor to monitor various instrument readings, control settings, aircraft states, or navigational profiles.

PHASE II QUESTIONNAIRE (Continued)

1. How often have you used each instructional feature? (Check the appropriate space.)

Feature	/never/rarely/occasionally/ /moderately/ often /frequently/very frequently/most often
Instructor Pilot Tutorial	/ / /

PHASE II QUESTIONNAIRE (Continued)

2. How easy is it to use each instructional feature? (Check the appropriate space.)

Feature	/ ?	/ most difficult/	/ very difficult/	/ difficult/	/ moderate/	/ easy	/ very easy/	/ easiest/
Instructor Pilot Tutorial								
Comments:								
Reset								
Comments:								
Total System Freeze								
Comments:								
Recorded Briefing								
Comments:								
Demonstration								
Comments:								
Record/Playback								
Comments:								
Environmental								
Comments:								
Automated Malfunction Insertion								
Comments:								
Partial Freeze								
Comments:								
Crash and/or Kill Override								
Comments:								
Motion								
Comments:								
Hard Copy								
Comments:								
Automated Adaptive Training								
Comments:								
Programmed Mission Scenarios								
Comments:								
Procedures Monitoring								
Comments:								
Parameters Monitoring								
Comments:								

PHASE II QUESTIONNAIRE (Continued)

3. How much training did you receive in the use of each instructional feature? (Check the appropriate space. Please comment as to whether the training was formal or informal.)

Feature	/ none /minimal/ some /moderate/considerable/great/greatest/
Instructor Pilot Tutorial	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Reset	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Total System Freeze	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Recorded Briefing	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Demonstration	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Record/Playback	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Environmental	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Automated Malfunction Insertion	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Partial Freeze	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Crash and/or Kill Override	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Motion	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Hard Copy	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Automated Adaptive Training	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Programmed Mission Scenarios	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Procedures Monitoring	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	
Parameters Monitoring	/ / / / / / / / 1 2 3 4 5 6 7
Comments:	

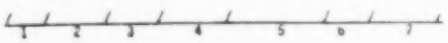
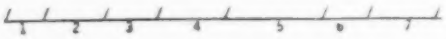
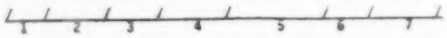
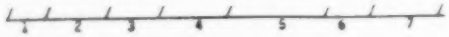
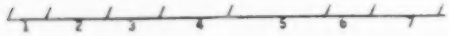
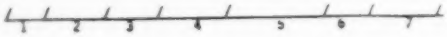
PHASE II QUESTIONNAIRE (Continued)

4. Rate the training value of each instructional feature. (Check the appropriate space.)

Feature	/ 1 / none /minimal/ some /moderate/considerable/great/greatest/ 0 1 2 3 4 5 6 7
Instructor Pilot Tutorial	
Comments:	
Reset	
Comments:	
Total System Freeze	
Comments:	
Recorded Briefing	
Comments:	
Demonstration	
Comments:	
Record/Playback	
Comments:	
Environmental	
Comments:	
Automated Malfunction Insertion	
Comments:	
Partial Freeze	
Comments:	
Crash and/or Kill Override	
Comments:	
Motion	
Comments:	
Hard Copy	
Comments:	
Automated Adaptive Training	
Comments:	
Programmed Mission Scenarios	
Comments:	
Procedures Monitoring	
Comments:	
Parameters Monitoring	
Comments:	

PHASE II QUESTIONNAIRE (Concluded)

5. Rate the potential training value of each instructional feature, including those you are not familiar with. Assume that you have had no experience using any of the features and that all of them are equally easy to . Therefore, base your ratings on the feature definitions alone. (Check the appropriate space.)

Feature	none /minimal/ some /moderate/considerable/great/greatest/
Instructor Pilot Tutorial	
Comments:	
Reset	
Comments:	
Total System Freeze	
Comments:	
Recorded Briefing	
Comments:	
Demonstration	
Comments:	
Record/Playback	
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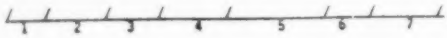
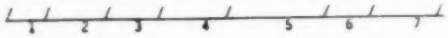
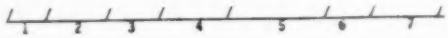
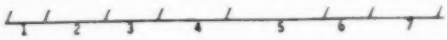
Environmental	
Comments:	
Automated Malfunction Insertion	
Comments:	
Partial Freeze	
Comments:	
Crash and/or Kill Override	
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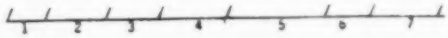
Motion	
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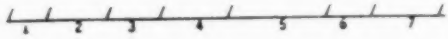
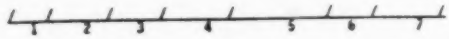
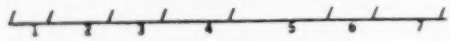
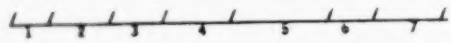
Hard Copy	
Comments:	
Automated Adaptive Training	
Comments:	
Programmed Mission Scenarios	
Comments:	
Procedures Monitoring	
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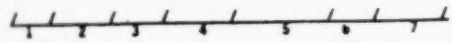
Parameters Monitoring	
Comments:	

PHASE III QUESTIONNAIRE

ADVANCED INSTRUCTIONAL FEATURES - EWI SURVEY

Name_____ Rank_____ Squadron_____ Date_____

FLYING EXPERIENCE:

Aircraft	Total Hours	Instructor Hours
_____	_____	_____

SIMULATOR EXPERIENCE:

Simulator	Total Hours	Instructor Hours
_____	_____	_____

1. What percent of your initial instruction on simulation training consisted of formal classroom instruction and what percent consisted of informal instruction?

_____% formal classroom _____% informal

2. Have you had refresher training on simulation operation? _____ yes _____ no
(If no, skip next two items.)

   a. How long has it been since you last had refresher training? _____ weeks

   b. What percent of your refresher training was formal and what percent informal?

_____% formal classroom _____% informal

BRIEFLY DESCRIBE A "TYPICAL" TRAINING SESSION ON THIS SIMULATOR:

_____

_____

_____

_____

_____

_____

GENERAL COMMENTS AND/OR RECOMMENDATIONS:

_____

_____

_____

_____

_____

_____

Read the definitions of each instructional feature carefully. In the space next to each feature, write the single number corresponding to the statement that best describes the operational status of that feature:

0. The simulator has no such capability.
1. Capability present but I have never seen it operate.
2. Capability present but unreliable.
3. Capability present and reliable.

____ Instructor Tutorial - provides the instructor with self-paced programmed instruction in the capabilities and use of the simulator.

____ Reset - permits instructor to "return" the simulated aircraft to a stored set of conditions and parameters.

____ Total System Freeze - permits instructor to interrupt and suspend simulated flight by freezing all system parameters.

____ Partial Freeze - permits instructor to freeze various flight parameters or parameter combinations such as altitude, heading, position, attitude, flight system, etc.

____ Recorded Briefing - permits instructor to provide student with information about a structured training session through audio/visual media presentation.

____ Demonstration - permits instructor to demonstrate optimal electronic warfare procedures by prerecording and subsequently playing back a simulated engagement.

____ Record/Playback - permits instructor to record and subsequently playback a segment of simulated flight.

____ Automated Malfunction Insertion - permits instructor to pre-program a sequence of aircraft component malfunctions and/or emergency conditions.

____ Hard Copy - provides a record of alphanumeric and/or graphic performance data for debriefing purposes.

____ Programmed Threat Control - computer-controlled standardized training sessions based on pre-programmed event sequences.

____ Manual Threat Control - permits instructor to modify threat scenarios during a training session.

____ Procedures Monitoring - permits instructor to monitor discrete actions performed by the student in accordance with a procedurally defined checklist.

____ Parameters Monitoring - permits instructor to monitor various instrument readings, control settings, aircraft states, or navigational profiles.

____ Electronic Warfare Performance Scoring - provides a performance metric that summarizes the outcomes of EW engagements.

PHASE III QUESTIONNAIRE (Continued)

1. During five typical missions, how often did you use each instructional feature? (Check the appropriate space.)

	N/A	Never	Once Every 5 Missions or Less	Once Every 2-4 Missions	Once a Mission	2-4 Times a Mission	5-7 Times a Mission	8 or More Times a Mission
Instructor Tutorial		0	1	2	3	4	5	6	7
Comments:									
Reset		0	1	2	3	4	5	6	7
Comments:									
Total System Freeze		0	1	2	3	4	5	6	7
Comments:									
Partial Freeze		0	1	2	3	4	5	6	7
Comments:									
Recorded Briefing		0	1	2	3	4	5	6	7
Comments:									
Demonstration		0	1	2	3	4	5	6	7
Comments:									
Record/Playback		0	1	2	3	4	5	6	7
Comments:									
Automated Malfunction Insertion		0	1	2	3	4	5	6	7
Comments:									
Hard Copy		0	1	2	3	4	5	6	7
Comments:									
Programmed Threat Control		0	1	2	3	4	5	6	7
Comments:									
Manual Threat Control		0	1	2	3	4	5	6	7
Comments:									
Procedures Monitoring		0	1	2	3	4	5	6	7
Comments:									
Parameters Monitoring		0	1	2	3	4	5	6	7
Comments:									
Electronic Warfare Performance Scoring		0	1	2	3	4	5	6	7
Comments:									

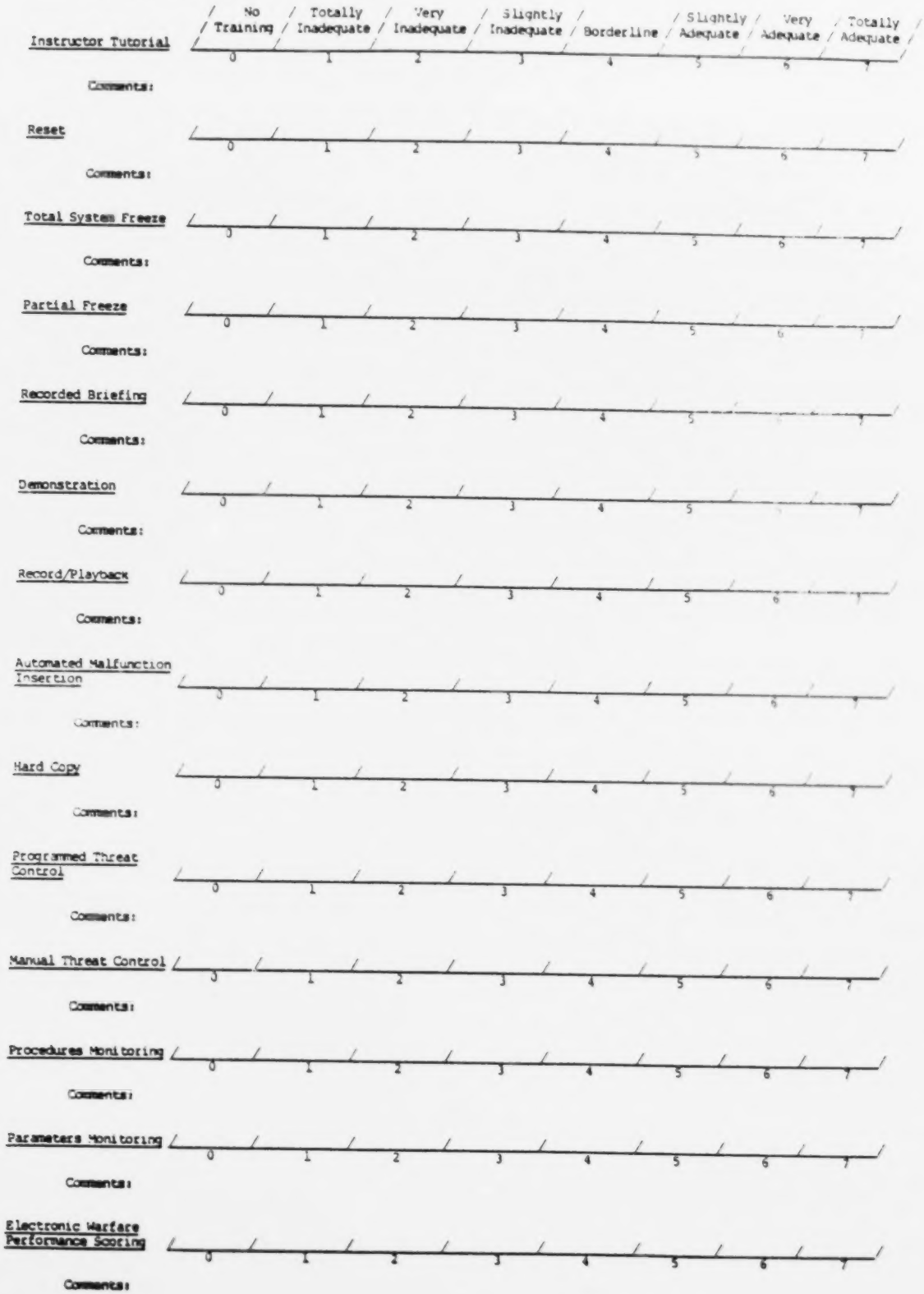
PHASE III QUESTIONNAIRE (Continued)

2. How difficult/easy is it to use each instructional feature? (Check the appropriate space.)

	N/A	0 Virtually Impossible	1	2 Very Difficult	3 Fairly Difficult	4 Neither Easy Nor Difficult	5 Fairly Easy	6 Very Easy	7 Virtually Automatic
Instructor Tutorial									
Comments:									
Reset									
Comments:									
Total System Freeze									
Comments:									
Partial Freeze									
Comments:									
Recorded Briefing									
Comments:									
Demonstration									
Comments:									
Record/Playback									
Comments:									
Automated Malfunction Insertion									
Comments:									
Hard Copy									
Comments:									
Programmed Threat Control									
Comments:									
Manual Threat Control									
Comments:									
Procedures Monitoring									
Comments:									
Parameters Monitoring									
Comments:									
Electronic Warfare Performance Scoring									
Comments:									

PHASE III QUESTIONNAIRE (Continued)

3. How inadequate/adequate was the training you received in the use of each instructional feature? (Check the appropriate space.)



PHASE III QUESTIONNAIRE (Continued)

4. As presently implemented on your system, how useful is each instructional feature? (Check the appropriate space.)

	N/A	0 Not Useful	1	2 Slightly Useful	3 Fairly Useful	4 Moderately Useful	5 Very Useful	6 Extremely Useful	7 Indispensable
Instructor Tutorial									
Comments:									
Reset									
Comments:									
Total System Freeze									
Comments:									
Partial Freeze									
Comments:									
Recorded Briefing									
Comments:									
Demonstration									
Comments:									
Record/Playback									
Comments:									
Automated Malfunction Insertion									
Comments:									
Hard Copy									
Comments:									
Programmed Threat Control									
Comments:									
Manual Threat Control									
Comments:									
Procedures Monitoring									
Comments:									
Parameters Monitoring									
Comments:									
Electronic Warfare Performance Scoring									
Comments:									

PHASE III QUESTIONNAIRE (Concluded)

5. Based on the definitions alone and not your experience, how potentially useful is each instructional feature. Rate each feature. Assume each is equally easy to use. (Check the appropriate space.)

	Not Useful (1)	Slightly Useful (2)	Fairly Useful (3)	Moderately Useful (4)	Very Useful (5)	Extremely Useful (6)	Indispensable (7)
Instructor Tutorial							
Comments:							
Reset							
Comments:							
Total System Freeze							
Comments:							
Partial Freeze							
Comments:							
Recorded Briefing							
Comments:							
Demonstration							
Comments:							
Record/Playback							
Comments:							
Automated Malfunction Insertion							
Comments:							
Hard Copy							
Comments:							
Programmed Threat Control							
Comments:							
Manual Threat Control							
Comments:							
Procedures Monitoring							
Comments:							
Parameters Monitoring							
Comments:							
Electronic Warfare Performance Scoring							
Comments:							

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